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**A Theory of the Labor Market
for
Persons with Disabilities**

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Executive Summary
A Theory of the Labor Market
for Persons with Disabilities

by

Walter Y. Oi and Emily S. Andrews

I. Introduction & Summary

The profile of disability and work is well-known. Persons with disabilities are less likely to work than persons who do not have disabilities. Older persons with disabilities and persons with fewer years of education are less likely to be in the labor force.

This report expands on these facts and examines how disabling conditions may affect employment and earnings. We advance the argument that both the presence of functional limitations and the impairment or condition causing that limitation must be investigated. We examine these issues from the standpoint of labor supply and employer demand. Within this context, we seek to explore the ramifications of the Americans with Disabilities Act (ADA) of 1990.

The employment and earnings of persons with disabilities is influenced by factors not faced by workers without disabilities. The labor supply of persons with disabilities is influenced by work-related costs and time constraints which tend to reduce the willingness of individuals to work full-time or work at all. The amount of labor supplied by workers with different health conditions and impairments is likely to vary across the population with disabilities, as well.

In general, we **find** that large employers will be able to respond more favorably to the ADA as they can limit essential job functions and provide accommodations more easily than small employers. Large employers whose Workers Compensation is self-insured or experience rated also have **financial** incentives to retain workers who become disabled on the job.

II. Time in a Static Labor Supply Model

The effect of disability on work can be analyzed theoretically by directly incorporating health status into a model of labor supply. For this purpose, health can be envisaged as a collection of traits which describe different physical functions. Within this context, functions operating below a certain level can be classified as disabilities.

The onset of a disabling condition may alter labor-leisure decisions in three distinct ways. First, health can directly affect individuals' preferences, and hence the demand for leisure. Second, health can affect productivity, and through that, wages. Third, health can influence time available for work and leisure. Persons with disabilities require more maintenance time and, consequently, have less time for other purposes.

III. Impairments, Limitations, and Major Life Activities

The characterization of disability by an indicator of health status must be modified to study the effects of different kinds of disabling conditions. In addition to a health variable, however, a functional limitation variable is needed which describes the ability or capacity to perform various functions or major life activities.

Policymakers and researchers have traditionally preferred a definition of disability based on functional limitations, rather than one based on health. This implies that the mapping from health status to function is not the same across all individuals. Furthermore, a substantial limitation in an activity depends on the activity and the environment in which the activity takes place.

Researchers have largely ignored the links connecting limitations to impairments. Nonetheless, health deteriorates at different rates, with sharply rising mortality rates for cancers, digestive, and circulatory impairments. Thus, from an analytic viewpoint, disability ought to be described by both functional limitation and by health condition or impairment.

III. Dynamics of the Adjustment to Disability

A variety of factors, including age, severity, and the nature of the disability, must be considered since they affect the dynamics and costs of the adjustment to disability. Furthermore, the age of onset of the disability is likely to affect the adjustment process as well.

A. Work Related Costs

Work related costs, including travel, generally affect the decision to enter the labor force. These costs may **increase** after the onset of a disability and affect the allocation of time to market and non-market activities. Different types of impairments and limitations may affect labor supply differently depending upon their impact on work-related costs.

B. Work Schedules and Occupations

A decrease in the amount of time that can be devoted to work or leisure suggests that persons with disabilities will wish to work shorter hours, especially during the immediate adjustment period following the disabling event. This will result in a decrease in an individual's wage rate relative to full-time employment. Such reductions depend upon the particular occupation and industry in question. Consequently, the impact of disability on earnings is related both to the type of impairment and to the occupation and industry of the individual concerned.

C. Disability -- Its Duration and **Impact** on Length of Life

Age has a significant impact on the probability that individuals with disabilities will continue to work. The interaction of age and labor force participation may arise in a number of ways. For instance, the age of disability onset will affect **the** decision of an individual to -invest in vocational rehabilitation and, hence, in subsequent employment_ Furthermore, two individuals

of the same age but with different impairments will exhibit different labor market responses depending on the relation of the impairment to the probable length of life. Life-shortening disabilities will reduce the length of the individual's working career and encourage earlier withdrawal from the labor force.

Research indicates that there are regularities in differences in mortality according to health condition. This suggests that it is necessary to identify both the presence of a work limitation and the impairment or chronic condition that is its cause.

D. Family Labor Supply Responses

When a household is composed of more than a single individual, the presence of a household member with a disability is likely to affect the labor force behavior of other members, notably the spouse. In a first approximation, a reduction in the health and wages of one member of the family will increase the work effort of that member's spouse. However, in a second approximation, in which time is allocated to work, home production, and leisure, disability may be accompanied by a reduction in the spouses' labor supply to assist and care for the partner with a disability.

E. Public Transfers and Work Incentives

Many individuals are eligible for disability insurance **programs** that provide medical and cash benefits in the case of disability. Some programs provide funds without any restrictions on earnings or work, while others are subject to earnings or income tests. Policymakers face difficult trade-offs between providing adequate income maintenance for persons truly unable to work and supplying proper incentives for individuals with moderate disabilities to remain employed.

IV. The Demand for Workers with Disabilities

While many earlier studies have focused on the impact of disability on labor supply, the demand for labor by employers is as crucial in explaining difference in patterns of employment and earnings among individuals with disabilities, particularly in the context of the ADA. The demand for labor by employers is related to wages and any associated costs of employing workers. Investments in work-place accommodations can be analyzed as an associated employment cost.

A. Productivity and Essential Functions

The Equal Employment Opportunities Commission (EEOC) has embraced a threshold hiring standard that is determined by the essential functions of the job. If a job is narrowly described, it is easier to ascertain whether an individual is qualified. Larger **firms** can theoretically **define** a smaller set of essential functions for a job than smaller **firms**, since larger **firms** can more easily assign specialized tasks to particular workers.

B. Accommodations and Labor Productivity

Employer investments in hiring and training are made voluntarily if they raise labor productivity. The costs of accommodating workers with disabilities can be viewed in a conceptually similar manner. According to the EEOC regulations, an accommodation is any change in the work environment, or in the way work is customarily performed, that enables a person with disability to do the essential functions of a job. Employers will voluntarily make accommodations that raise productivity by more than the cost. Under the ADA, accommodation is no longer voluntary.

The effect on the employer demand for workers with disabilities will depend upon the definition of reasonable accommodation and on the penalties that are levied on employers for non-compliance. More jobs are likely to be provided by large employers who both have the wherewithal to assume accommodation costs and who have large enough work forces to reduce the number of essential functions that have to be performed by qualified persons with disabilities. In addition, if accommodation rests in the opportunity for part-time employment, industrial pay differentials for part-time workers will affect both the supply and demand for individuals with disabilities.

C. Implicit and Explicit Wage Subsidies.

A wage subsidy can expand employment for members of a target group. For instance, vocational rehabilitation could be viewed as an implicit subsidy to the individual or firm, in the sense that the public sector assumes the costs of retraining a person with a disability.

Because most employers with 500 or more employees are self-insured for Worker Compensation benefits, it may be cost-effective for such **firms** to bring injured workers back into their work force even if their value to the employer does not exceed the wages that must be paid. This implicit subsidy (via lower Worker Compensation costs) is absent for the small employers, however, who are neither self-insured nor experience-rated.

D. Wage and Employment Discrimination.

Hearings preceding the passage of the ADA concluded that widespread discrimination exists against persons with disabilities. Statistical evidence about the extent of discrimination, however, is scarce. While surveys indicate that many individuals with disabilities who are not employed report that they would like to work, the interpretation of these responses is unclear. Suitable jobs may simply not be available.

Only one study has estimated the extent of wage discrimination faced by workers with disabilities. While that study found a relatively large differential, the study may have overestimated the effect of discrimination. Consequently, the extent of discrimination faced by persons with disabilities is not clearly quantified in comparison to estimates of the extent of discrimination faced by women or minorities. The theoretical and statistical issues related to the analysis of disability are more complicated as well.

V. Conclusions

Economic theory indicates that the labor supply responses of persons with disabilities will be different from those of persons without disabilities precisely because disability steals time. Persons with disabilities need more time to take care of daily needs. Furthermore, time consumed by transportation to and from work may be longer. Finally, health care maintenance needs are likely to be greater. While these theoretical considerations **are** clear, more empirical work is needed to identify the magnitude of these affects.

By contrast, considerable research has focused on the impact of income maintenance programs and insurance payments on the labor supply of individuals with disabilities.⁷ Theoretically, disability income payments reduce labor supply. Empirical research has confirmed this hypothesis. Relatively less research has been conducted on family labor-supply responses. Furthermore, the direction of these responses is indeterminate.

Perhaps most important, the labor-supply responses of persons with disabilities are likely to differ depending on the health condition and impairment leading to the work disability. Further research on this topic is essential if we are to discover how to encourage greater labor force participation among individuals with disabilities.

Most observers consider that workers with disabilities are disadvantaged because they face discrimination unrelated to their productive capacities. Few studies have addressed this issue directly. Neither the extent of wage discrimination nor the extent of hiring discrimination is well-documented.

In other words, viewed from the employer side of the labor market, little attention has been given to the factors affecting labor force demand. These considerations must be understood to evaluate the impact of the ADA. The interpretation of essential function and accommodation will be crucial in such an analysis. These factors will influence the degree to which the ADA will effectively expand opportunities for individuals with disabilities and the extent to which these opportunities will be centered in large **firms**.

⁷The most important of these studies are summarized in Appendix B.

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I. Introduction

The language of the Americans with Disabilities Act conveys a clear message that there is an identifiable minority of **persons with disabilities** who can be distinguished from the majority of individuals without disabilities. However, the regulations to implement the Act, promulgated by the Equal Employment Opportunities Commission, contradict this message and explicitly state that **disability** and the concept of “a qualified individual with a **disability**” have to be determined on a case by case analysis.

For the March **Current Population Survey (CPS)** the Bureau of the Census relies on self assessments to measure the population of working age adults with a work disability. In the March 1988 CPS, 13.4 million working age Americans (8.6 percent of the population) reported that they had a work limitation (Bennefield and McNeil, 1989). The incidence of work disability climbs with age from 3.8 percent of the youngest adults to 22.3 percent of 55-64 year-olds. Holding age constant for persons **45-54** years of age, the incidence **falls** from 21.3 percent for high school dropouts to 4.3 percent for college graduates. Bennefield and **McNeil** report that surveys designed to ascertain disability or health status produce higher incidence rates, 12.5 percent for the 1984 SIPP and 11.5 percent in the 1983 Health Interview Survey. The elastic nature of just who is **disabled** has to be kept in mind when dealing with labor markets for persons with disabilities.

Only 27.8 percent of working age adults with disabilities in March 1988 were gainfully employed compared to 74.4 percent of adults without disabilities. The ratios of **full-time** employees to population were 18.2 and 60.6 percent. For persons with disabilities, the employment to population ratio declines with age. Even when they **find** work, men with disabilities are paid lower wages. Their mean annual earnings in 1987 were \$15,497, which was only 64 percent of the earnings of men without disabilities. In spite of the fuzzy measure of the population of adults with disabilities, the data strongly indicate that if you truly have a disability, you are far more likely to be out of work and have an income which puts you below the poverty line.

These empirical regularities are well-known. What is missing is the way in which disability affects the behavior of the affected individuals, **especially** with respect to their actions in the labor market. Although most researchers are fully aware of the fact that there are varying degrees of disability, the data compel them to treat disability as a dichotomous variable. In this report, we try to examine how various disabling conditions affect the employment and wages of **individuals with disabilities**. In Section II, we develop a static labor supply model in which an individual's stock of health capital affects his or her preferences, wages, or discretionary time

endowments. Section III directs attention to the links between impairments and functional limitations. The impairment or chronic condition that is mainly responsible for a work or activity limitation is systematically related to the age of the individual. We advance the argument here that it is important to identify not **only** the presence of functional limitations but also the impairment or condition causing that limitation. In Section IV, we examine some dynamics of the adjustment to disability. In addition to the role of work-related expenses and the choice of a work schedule and occupation, the reason for the limitation tells us a great deal about how the disabling condition affects the lifetime horizon. The last two parts of Section IV examine the effects of family labor supply responses and public income transfers on the labor market activities of people with disabilities. Section V turns to the demand for workers with disabilities. It begins with the concept of *essential functions* as a way to ascertain the adequacy of the productivity of an individual with a disability. We next turn to how workplace accommodations can affect labor productivity. We examine the sizes of implicit and explicit subsidies for hiring persons with disabilities. We close with the effects of labor market discrimination on the employment and earnings of persons with disabilities.

II. Time in a Static Labor Supply Model

In the labor supply model of Lionel Robbins (1930), the utility maximizing supply of labor, measured by work hours per period H , is determined by tastes and three exogenous variables; the hourly wage rate W , non-wage income Y , and a time endowment T which is allocated to leisure L and work H . For an interior maximum, the labor supply function can be written,

$$(1.1a) \quad H = H(W, F) = H(W, WT+Y)$$

where $F = WT+Y$ is full income. It is possible that an individual will locate at a corner equilibrium.

$$(1.1b) \quad H = 0, \text{ if } q = \hat{W}/W = q(Y, T, W) < 1$$

where $\hat{W} = U_L/U_X$ is the shadow wage, the marginal rate of substitution of corn X for leisure L evaluated at the corner bundle, $\{X=Y, T=L\}$. Disability can affect utility and labor supply through its impact on tastes or the three exogenous variables

Each person can be imagined to possess a vector of health traits, $[a_1, a_2, \dots, a_n]$ describing the effectiveness of various human organisms. For analytic ease, assume that this vector can be described by a scalar index A called *health capital*. Following Michael Grossman (1972), *disability can* be defined as a state where A falls below some critical level A_c . Severity might be measured by the gap $(A_c - A)$. This analytic simplification sweeps aside any differences associated with various kinds of disabling conditions or effects arising out of interactions of specific health traits and the several dimensions of the person's stock of *human capital*. It permits us to explore the ways in which an exogenous change in an individual's stock of *health capital* affects utility and labor supply.

The onset of a disabling condition may alter an individual's preferences for corn and leisure. To examine this path, it is convenient to include A in the utility function, $U = U(X, L, A)$. Less health reduces utility, $(dU/dA) = U_A > 0$, but it could also affect the marginal rate of substitution, $r = (U_L/U_X)$. If poorer health increases the marginal value of leisure time, meaning that $(dr/dA) < 0$, a fall in A will be accompanied by an increase in the demand for leisure time. As a consequence, the supply of labor, $H = T - L$, is reduced, possibly to the corner where $H = 0$. The labor force participation rate, earnings $E = WH$, and income $(WH + Y)$ will all be lower for persons with disabilities when $(dr/dA) < 0$.

Other things equal, an individual's productivity measured by the hourly wage W that he or she can command in the market will be positively related to the stock of health capital, $(dW/dA) > 0$. A fall in A reduces full income and puts the person on a lower indifference curve, but the supply of work hours could go in either direction depending on the strengths of the opposing substitution and income effects.

All of us get the same endowment of calendar time, $T^* = 168$ hours a week, but the hours allocated to maintenance of the human agent, T_m , sleep, recuperation, and time for physician/hospital visits, vary. Stafford and Duncan (1977) reported that persons with lower wages devoted more hours a day to sleeping. A more rigorous analysis of "The Economics of Sleep" was provided by Biddle and Hamermesh (1989). The hypothesis advanced in our study is that maintenance time is inversely related to the stock of health capital, $(dT_m/dA) < 0$. **Disability steals time.** Most persons with disabilities require more maintenance time and consequently have a smaller time endowment which can be allocated to work and leisure. A decrease in time T not only reduces utility via its impact on full income but unambiguously contracts the supply of work hours, $H = T - L$. Some individuals with disabilities will choose to withdraw from the labor force, and others may have to move from full to part-time employment. Indeed, a lo-percent decrease in the time endowment T leads to a larger reduction in work hours H than a lo-percent decrease in the hourly wage rate.

In this extension of the **Robbins** model, the onset of a disabling condition is equated to an exogenous reduction in the stock of health capital A . It can affect labor supply in three ways: (1) health capital can directly affect utility and hence the "tastes" for corn and leisure, (2) it can affect the hourly wage that an individual can command, $W = W(A)$ with $W'(A) > 0$, or (3) it can influence the time available for work and leisure, $T = T(A)$ with $T'(A) > 0$. These three paths are not mutually exclusive. A particular disabling condition could affect utility and labor supply through some combination of these three ways. In the last two paths, a decrease in health capital reduces full income, $F = WT + Y$. Poorer health can steal time over a diurnal cycle (the person requires more sleep or time for personal care), a year (more days of illness or time for physician visits), or a lifetime (by increasing mortality risks). These additional dimensions of time are explored in Section IV.

III. Impairments, Limitations, and Major Life Activities

The characterization of disability by a scalar index of health capital has to be modified to study the effects of different kinds of disabling conditions. The regulations promulgated by the Equal Employment Opportunities Commission contained the following definition.

"Disability means with respect to an individual (1) a physical or mental *impairment* that substantially *limits* one or more of the *major life activities* of such individual, (2) a record of such an *impairment*, or (3) being regarded as having such an *impairment*."

"Major life activities means functions such as caring for oneself, performing manual tasks, walking, seeing, hearing, speaking, breathing, learning, and working."

W.G. Johnson and J. Lambrinos (1985) refer to the World Health Organization **definitions** to distinguish among three terms.

"Impairment is a psychological, anatomical, or mental loss or some other abnormality. *Disability* is a restriction on or lack (resulting from an impairment) of an ability to perform an activity (work in this case) in the manner or within the range considered normal. *Hundicap* is a disadvantage resulting from an impairment or disability." [p. 265]

Mitchell LaPlante (1991) examined the National Health **Interview** Surveys to estimate the size of the population with various potentially disabling conditions which we can call *impairments*. In terms of our earlier model, define a health capital vector $A = (a_1, a_2, \dots, a_f)$, where a person has impairment "i" if a_i falls below some critical level \underline{a}_i . A larger value for a_i indicates a healthier state for that organism. The ability or capacity to perform various functions or major life activities could be described by a vector, $B = (b_1, b_2, \dots, b_f)$, where a person is *substantially limited* in performing function "f" if b_f is less **than** a critical level \underline{b}_f . Functional proficiency is surely related to health capital described by a mapping, $B = G(A)$. Policymakers and researchers seem to prefer a definition of disability based on functional limitations rather **than** one based on health capital suggesting **that** the mapping, $B = G(A)$ is *not the same* across individuals.

The problem is further complicated by the fact that the critical level determining a *substantial limitation*, "...an ability to perform an *activity* in the manner or within the range considered normal...", depends on the activity and the environment. An inability to reach or to lift could be a seriously disabling condition for a lobster fisherman but only a nuisance for a psychoanalyst. The latter might not even report this limitation in a survey. The role of workplace accommodations can be incorporated in a "production function" wherein performance or productivity is a function of both functional proficiency B and accommodating capital K; i.e. $Z = f(B, K)$. Equipment can be designed and acquired to substitute for a decrease in a person's lifting capacity.

The EEOC explicitly acknowledges that the ADA takes a different approach from the Civil Rights Act as it is applied to race and gender. When an individual's disability creates a barrier, an employer is required to consider whether a "reasonable accommodation" could remove the barrier. The Interpretative **Guidance** states that the ADA is intended to establish a **process**.

"This case by case approach is essential if qualified individuals of varying abilities are to receive equal opportunities to compete for an infinitely diverse range of jobs. For this reason, neither the ADA nor this regulation can supply the correct answer in advance for each employment decision concerning an individual with a disability."

Disability would seem to be a highly subjective state that defies quantification if these regulations issued by the EEOC are taken seriously.

The surveys that have been undertaken mainly rely on self reporting of functional limitations, activities of daily living, ADL, and impairments or chronic disabling conditions. They yield different estimates of the overall prevalence of disability but exhibit agreement on differences in the relative incidence rates due to age, race, gender, and education. **Alberto Martini** (1990) used the 1984 Survey of Income and Program Participation (**SIPP**) data and divided the population of working age adults into six mutually exclusive groups based on the number and severity of limitations. An inability to speak is surely a more serious limitation than not being able to see. More importantly, researchers have largely ignored the links connecting limitations to impairments.

An exception is found in the study by Mitchell **LaPlante** (1988) in which work and activity limitations were related to impairments and chronic conditions. His data summarized in Table 1 reveal that orthopedic impairments were the leading major cause of all work limitations accounting for 29.04 percent of the 17.4 million work disabled adults in **1983-85**.² The elements of the **health** capital vector A deteriorate at different rates with sharply rising incidence rates for cancers, digestive, and circulatory impairments. Only 11.36 percent of work limitations reported by 18-44 year-old adults were caused by these three conditions, but this figure climbs to 31.95 percent for the 45-69 year-old group. The shorter life expectancy of mentally retarded persons is responsible for the declining importance of mental conditions as a cause for work limitations. Table 2 presents the **LaPlante** estimates in relation to the age-specific U.S. populations. Some 5.82 percent of 18-44 year-old Americans reported a work limitation, and this incidence rate rose to 20.98 percent for the 45-69 year-old age group, a 3.6 fold rise in the work disability rate. The work disability rate due to orthopedic impairments rose from 2.32 to 4.78 percent. The functional limitations associated with ulcers are different from those due to hypertension or from partial paralysis of the lower extremities, and these differences will surely affect the kinds and costs of reasonable workplace accommodations.

TABLE 1
Percentage Distribution of Work Limitations by Major Cause
(by Age and Sex, 1983-85)

	All Ages	18-44	45-69
A. Both Sexes			
N = No. of Work Limitations	17401	5986	11415
Percentage Caused by			
1. Musculo-Skeletal	13.19	6.62	16.64
2. Orthopedic Impairments	29.04	40.91	22.81
2b. Blind & Visually Impaired	3.41	3.71	3.26
2d. Deaf and Hearing Impaired	1.82	2.59	1.41
3. Digestive	3.20	2.64	3.50
4. Circulatory	19.00	7.13	25.23
5. Respiratory	6.87	6.45	7.10
6. Miscellaneous	13.18	15.37	12.03
C. Cancer	2.66	1.59	3.22
M. Mental	7.63	13.00	4.82
B. Male			
N = No. of Work Limitations	8468	3063	5405
Percentage Caused by			
1. Musculo-Skeletal	9.15	5.06	11.47
2. Orthopedic Impairments	33.07	45.18	26.20
2b. Blind & Visually Impaired	3.91	4.80	3.40
2d. Deaf and Hearing Impaired	1.95	2.74	1.50
3. Digestive	2.63	2.51	2.70
4. Circulatory	19.96	5.55	28.12
5. Respiratory	7.52	5.62	8.60
6. Miscellaneous	11.36	13.39	10.21
C. Cancer	2.46	1.24	3.15
M. Mental	7.99	13.91	4.64
C. Female			
N = No. of Work Limitations	8933	2923	6010
Percentage Caused by			
1. Musculo-Skeletal	17.02	8.24	21.28
2. Orthopedic Impairments	25.22	36.44	19.77
2b. Blind & Visually Impaired	2.94	2.57	3.13
2d. Deaf and Hearing Impaired	1.69	2.43	1.33
3. Digestive	3.74	2.77	4.21
4. Circulatory	18.10	8.79	22.63
5. Respiratory	6.26	7.32	5.74
6. Miscellaneous	14.90	17.45	13.66
C. Cancer	2.84	1.95	3.25
M. Mental	7.29	12.04	4.98

Source: LaPlante, Mitchell P. (1988). *Data on Disability from the National Health Interview Survey, 1983-85. An InfoUse Report.* Washington, DC: U.S. National Institute on Disability and Rehabilitation Research. Table 7A.

TABLE 2
Incidence of Work Limitations by Age and Sex
(percentage of U.S. population)

	All Ages	18-44	45-69
A. Both Sexes			
0. All Causes	11.07	5.82	20.98
Percentage Caused by			
1. Musculo-Skeletal	1.46	0.39	3.49
2. Orthopedic Impairments	3.21	2.38	4.78
2b. Blind & Visually Impaired	0.38	0.22	0.68
2d. Deaf and Hearing Impaired	0.20	0.15	0.30
3. Digestive	0.35	0.15	0.73
4. Circulatory	2.10	0.42	5.29
5. Respiratory	0.76	0.38	1.49
6. Miscellaneous	1.46	0.89	2.52
C. Cancer	0.29	0.09	0.67
M. Mental	0.84	0.76	1.01
B. Male			
0. All Causes	10.98	5.96	21.00
Percentage Caused by			
1. Musculo-Skeletal	1.00	0.30	2.41
2. Orthopedic Impairments	3.63	2.69	5.50
2b. Blind & Visually Impaired	0.43	0.29	0.71
2d. Deaf and Hearing Impaired	0.21	0.16	0.31
3. Digestive	0.29	0.15	0.57
4. Circulatory	2.19	0.33	5.91
5. Respiratory	0.83	0.33	1.81
6. Miscellaneous	1.25	0.80	2.14
C. Cancer	0.27	0.07	0.66
M. Mental	0.88	0.83	0.98
C. Female			
0. All Causes	11.15	5.69	20.95
Percentage Caused by			
1. Musculo-Skeletal	1.20	0.47	4.46
2. Orthopedic Impairments	2.81	2.07	4.14
2b. Blind & Visually Impaired	0.33	0.15	0.66
2d. Deaf and Hearing Impaired	0.19	0.14	0.28
3. Digestive	0.42	0.16	0.88
4. Circulatory	2.02	0.50	4.74
5. Respiratory	0.70	0.42	1.20
6. Miscellaneous	1.66	0.99	2.86
c. Cancer	0.32	0.11	0.69
M. Mental	0.81	0.68	1.04

Source: Derived from data in Table 1

From an analytic viewpoint, disability ought to be described by both the functional limitation and impairment. The capacity to perform a particular function cannot always be described by a deterministic number, a value for say b_i ; it might be better described by a random variable with some mean B_i and dispersion σ_i . Two different impairments may result in the same measure for mean proficiency B_i but different dispersions. A person's manual dexterity might be limited by an injury to a muscle or by the development of arthritis. As Yelin (1991) points out, on a bad day, an arthritic individual may need more time in the morning to get started, but the person with the muscle injury may be permanently limited. The former may need a flexitime work schedule for his accommodation, while the latter may require special equipment. Additionally, knowledge about both the impairment and functional proficiency, $\{a_i, b_i\}$, conveys more information with respect to the length of the remaining work life, a subject examined in Section IV. We shall argue in this study that the particular impairment or condition causing the functional limitations is important in understanding the impact of disability on work and welfare.

IV. Dynamics of the Adjustments to Disability

Disability is rarely congenital. Sometimes, the onset of a disability can be tied to a specific cause, an accident or illness, but often, it appears to be the outcome of a random process. The odds that one will become disabled rise sharply with age. The age at onset, the severity and nature of the disabling condition, whether the condition was anticipated, the family and financial resources available to the person, its impact on mortality risks, all affect the dynamics and costs of the adjustment to disability.

A. Work Related Costs

The explicit and implicit costs of the journey to work and for special equipment, protective clothing, or tools affect the decision to enter the labor force. These costs also influence the supply of labor, meaning the allocation of time to market and non-market activities. The responses to the onset of a disability depend on the size of these work related costs, the nature of the disability (the particular impairments or chronic conditions and the severity of the resulting functional limitations), and the characteristics of the prior job.

Following G. Hanoch (1975), we adopt a model in which leisure time on non-workdays L_1 is an imperfect substitute for leisure time on workdays L_2 . The individual maximizes utility, $U = U(L_1, L_2, X)$ subject to time and money budget constraints. Suppose that the individual works on K of the N days in a year. Let $T = (T^* - T_m)$ denote the time endowment per day net of maintenance time. On workdays, T is divided among work hours H , time for the work trip J , and daily leisure hours L_d ; the time available for work and leisure is thus $\tau = T - J = H + L_d$. The two leisure demands are thus given by,

$$L_1 = (N-K)T, \quad L_2 = KL_d = K(\tau - H)$$

The supplies of hours a day H and man hours a year $M = KH$ are thus given by,

$$H = \tau - \frac{L_2}{K} = \tau - \frac{TL_2}{TN - L_1} \quad (1)$$

$$M = KH = TN - \left(\frac{\tau}{T}\right) (L_1 + L_2) \quad (2)$$

The price of corn is taken to be unity, while c is the money cost of a work trip. The money budget constraint is thus $X + cK = WM + Y$. Substituting for K and H , we get a single constraint where “outlays” for the two kinds of leisure and corn exhaust **the full income** F .

$$(3.2) \quad V_1 L_1 + W L_2 + X = F = V N + Y$$

where $V_1 = (W\tau + c)/T$ and $V = (W\tau - c)/T$. The implicit cost for an hour of non-workday leisure V_1 is less than that for an hour of leisure on a workday W if the time cost of the work trip exceeds the relative money cost.³

Based on the data assembled by **Stucker (1975)**, C was around \$3.40 for an auto work-trip which required around 46 minutes for an 8 mile trip. If a worker attaches a value to travel time equal to one-third of his hourly wage assumed here to be $W = \$5$ (this value is consistent with the findings of **Beesley (1965)**), the full cost of the daily work trip is substantial, $[(WJ/3) + C] = \$4.68$ which is 11.7 percent of his daily wage, $WH = \$40$. The introduction of two types of leisure leads to some interesting outcomes. It is possible that a rise in the wage rate could lead to a decrease in the supply of workdays K but an increase in the supply of hours a day H (see **Oi, (1976)** for the necessary conditions).

A disabling condition that contracts $T = (T^* - T_m)$ reduces the demand for non-workday leisure L_1 through its impact on full income but its effect on the supply of workdays K is indeterminate: It will, however, unambiguously raise the shadow wage \hat{W} prompting some persons to withdraw from the labor force. This outcome is strengthened if the disabling condition simultaneously reduces T and increases the trip time J . Some impairments may have no effect on the time and money costs of travel, but other limitations which increase these parameters could reduce labor supply. A definition that identifies both the impairments and limitations allows us to study the way in which disability affects labor supply.

B. Work Schedules and Occupations

The discretionary time endowment net of maintenance and commutation was presumed to be devoted to work and leisure. A decrease in this discretionary time due to a disability reduces the supply of work hours possibly to the point of withdrawal, $H = 0$. By implication, those who want to supply only 20 hours of work a week will be forced to accept part-time jobs.

Following the seminal article of Gary S. Becker (1965), R. Gronau (1973), Michael Grossman (1972), and Donald Parsons (1977) developed models in which time can be allocated to market work H, (internal) home work I, or leisure L; $T = H+I+L$. Recuperation, rest, and rehabilitation all take *time* which leaves less time for work and leisure. In the period shortly following onset, an individual is likely to allocate more internal time I to the production of health capital. Persons with disabilities can be expected to demand shorter hours especially during the immediate adjustment period. If this means a move to a part-time job, hourly wages will be lower.

The attractiveness of short hours or complete withdrawal from the labor force may be enhanced by the stochastic character of functional proficiencies. Physician visits, prescriptions, and hospital days are systematically related to the degree of activity limitation as shown in Table 3. Greater uncertainty is likely to discourage a person from taking a job requiring a regular work schedule. Consider two individuals who will miss work for an average of 10 days a year. Person A may miss from 8 to 12 days a year, while B has a wider variance missing from 2 to 18 days. The latter person is more likely to be dismissed for excessive absenteeism and hence more reluctant to take the job. The hourly wage discounts for part-time and irregular work schedules vary widely across industries and occupations. Sales and service workers frequently receive "payment by results" or piece rates where the wage discount is considerably smaller. The hourly rates for nurses who work a full-time 40-hours schedule are only slightly above those who work three days a week. However, in manufacturing plants, part timers receive considerably less pay per hour than full timers; a differential **that** is even wider when one includes the value of fringe benefits. A manufacturing worker who becomes disabled may be better off by moving to the service sector if she can obtain employment. Those individuals who are both employed and have a work limitation are more heavily represented in the public sector, in part-time jobs, and in self employment. These patterns corroborate the implications of a model in which disability mainly *steals time*.

C. Disability---Its Duration and Impact on the Length of Life

Disability measured by survey responses is largely a transitory state. Of 1,760 white married male household heads in 1972, 13.1 percent reported that they were disabled, but only 4.9 percent were disabled for five consecutive years, 1968-72.⁵ Lucas and Rapping (1969) and Ghez and Becker (1975) argued that the labor market responses to a temporary wage change differ from those to permanent wage changes. A similar difference should be observed for responses to temporary vs. permanent disabling conditions.

Lucas and Rapping correctly argued that a temporary wage cut will bring forth a larger decrease in the current supply of work hours (when compared to a permanent wage cut of the same magnitude) because the worker will substitute current for future leisure; i.e. he **will** forego working in the current period knowing that the wage cut **will** be restored in the next period. At onset, a worker with a disability is uncertain about whether the condition will affect his or her

TABLE 3

Health Care Utilization by Degree of Activity Limitation, 1977 (Ages 18 to 64, United States)				
Item	Activity Limitation			
	None	Minor	Major	Severe
1. Physician Visits				
a. Number Per Person	3.6	7.2	8.0	9.6
b. Relative Expenditures	1.0	1.9	2.2	2.7
2. Hospital Care				
a. Discharges/a	11.3	20.1	35.6	66.5
b. Average Length in Days	5.2	8.1	10.1	14.3
c. % Hospitalized Once/b	12.8	19.3	24.6	30.1
d. % Hospitalized 3+	0.4	1.2	2.0	3.9
e. Relative Expenditures	1.0	3.8	4.0	6.1
3. Prescribed Medicines				
a. Number Per Person	3.7	9.9	13.1	17.3
b. Relative Expenditures.	1.0	2.8	4.0	5.1

Source: Table 4 from G. DeJong, A. I. Batavia, and R. L. Griss, *America's Neglected Health Minority*, (1989)

/a- Data from the 1977 National Medical Care Expenditures Survey

/b- 1979 Health Interview Survey, Discharges per 100 persons

her wage rate or time endowment or how long this effect will persist. Impairments are rarely stable but change from week to week. He or she may want to wait to ascertain the extent of their sight loss before deciding on whether to try to return to their old job, to retrain for a new job, or to withdraw from the labor force. The decrease in work hours in the short term is likely to be even greater if the individual thinks that the impairment might be reversed by allocating more time and money to health restoration.

A theory of human capital predicts that the investment in training will be greater, the larger is the increment to wages (productivity) due to the training and the longer is the anticipated period of **employment**.⁶ The age at onset will surely affect the decision to invest in vocational rehabilitation. Those who become disabled within a few years of the age at which they would have ordinarily retired are unlikely to invest in training for a new occupation. Indeed, the ratio of persons with disabilities who are gainfully employed is inversely related to age. The age at onset is rarely reported in most data sets, but the nature of the disabling condition could serve as an imperfect proxy for it. Disabling limitations caused by mental retardation or mental illness occur relatively early in life, while those resulting from cancers, circulatory, and digestive impairments occur much later in life. Persons who suffer from speech, sight, or audio impairments before they are 40 years of age are far more likely to receive special training and to be employed than similarly impaired individuals who **become** disabled at an older age. Older rehab clients or those who have impairments associated with aging have, on average, shorter remaining working lives and hence realize lower returns from rehab training. Theory thus predicts that the attrition rate from vocational rehabilitation training programs should be positively related to the age of the client.

In addition to an inability to perform a task or activity “in the manner or within the range considered normal”, a person with a disability has a shorter life expectancy. This point was documented by John Bound (1989). Mortality rates were higher for persons receiving benefits from the Social Security Disability Insurance, SSDI, program. Additionally, those who applied for SSDI and who were denied benefits experienced higher mortality rates than individuals without disabilities who never applied for disability benefits. Two individuals of the same age but different impairments will exhibit different labor market responses depending on the relation of the impairment to the probable length of life. An inter-temporal labor supply model such as the one developed in Appendix A predicts that a life shortening disability will reduce the length of the individual’s working career and encourage an earlier withdrawal **from** the labor force.

Barry V. Bye and Gerald F. Riley (1989) followed the cohort of 18,782 persons who were awarded benefits and enrolled in the Social Security Disability Insurance program in 1972.’ The percentages of this cohort who died or recovered (and hence were dropped from the program) during the next two years were determined from Social Security records. In Table 4, we reproduce their findings classified by (a) sex and race, (b) Age at entry into the program,

TABLE 4
Two-year Death and Recovery Rates for the 1972 Entrants to SSDI

		1972 Cohort		Percentage in the first two years who	
		Number	Per Cent	Died	Recovered
b/	Total	18782	100.0	12.8	5.3
c/	Sex and Race				
d/	Men	13150	70.0	13.9	6.0
e/	Women	5632	30.0	10.4	3.7
f/	White and Unknown	15958	85.0	12.8	5.4
g/	Black	2617	13.9	13.2	4.7
h/	Other	207	1.1	8.2	5.8
i/	Age in 1972				
j/	Under 40	2961	15.8	6.7	15.2
k/	40-49	3602	19.2	13.4	7.9
l/	50-59	9407	50.1	14.0	2.6
m/	60-61	2812	14.9	14.8	0.6
14/	Years of Education				
15/	None	215	1.1	10.7	1.4
16/	1-8	6540	34.8	12.2	3.2
17/	9-12	8180	43.6	14.4	6.7
18/	13 or More	1459	7.8	15.4	8.4
19/	Unknown	2388	12.7	8.1	4.7
20/	Occupation				
21/	Professional	1878	10.0	17.2	-9.9
22/	Clerical & Sales	2266	12.1	14.5	9.1
23/	Service	2656	14.1	12.1	8.1
24/	Farming	757	4.0	10.8	4.4
25/	Precessing	564	3.0	13.3	4.8
26/	Machine	1632	8.7	12.8	5.8
27/	Benchwork	1164	6.2	10.3	4.4
28/	Structural	2220	11.8	12.5	6.1
29/	Misc.	2847	15.2	12.8	6.4
30/	Unknown	2798	14.9	11.2	5.6
31/	Diagnostic Group				
32/	Infectious	319	1.7	7.2	23.2
33/	Neoplasms	1582	8.4	64.5	1.9
34/	Endocrine	613	3.3	12.6	1.6
35/	Mental	1736	9.2	3.3	4.7
36/	Nervous	681	3.6	6.3	2.8
37/	Rye and Ear	385	2.0	4.2	4.9
38/	Circulatory	5321	28.3	12.3	2.5
39/	Respiratory	1163	6.2	10.2	1.0
40/	Digestive	542	2.9	22.5	4.2
41/	Genitourinary	128	0.7	25.0	6.3
42/	Musculoskeletal	2883	15.3	2.7	6.8
43/	Traumatic	1260	6.7	2.5	22.1
44/	Other	2179	11.6	6.6	5.2

(c) Years of Education, (d) Occupation, and (e) Diagnostic Group. These people are really not well as evidenced by the fact that over one-eighth, 12.8 percent, died within two years. Only 5.3 percent recovered and were dropped from the Social Security rolls. The two-year mortality rates were higher for men and blacks, and rose with age at entry.⁸ More educated SSDI beneficiaries experienced a higher two-year mortality rate, but it is suspected that this is a result of the interaction between education and age at onset. The more educated persons with disabilities probably became disabled after they were 50 or older. The surprising finding is the wide variance in death rates by diagnostic group. Nearly two-thirds, 64.5 percent, of those who were disabled by neoplasms (cancers) passed away within two years of admission to the SSDI program. High mortality rates were also observed for those with genitourinary and digestive conditions, 25.0 and 22.5 percent died within two years. People whose disabilities were caused by traumatic injuries had the lowest mortality rate, 2.5 percent, followed by musculoskeletal impairments, 2.7 percent. The highest recovery rates were reported by beneficiaries whose limitations were caused by infectious diseases, 23.2 percent, and traumatic injuries, 22.1 percent. These empirical regularities reported by Bye and Riley (1989) are striking and suggest to us that it is imperative that we identify not only the presence of a **work limitation** but also the **impairment** or **chronic condition** which is the principal cause of the limitation.

D. Family Labor Supply Responses

Some contend that the appropriate unit of analysis is the **household**. When a household is more than a single **individual**, the presence of a household head with a disability is likely to affect the behavior of the other members, notably the spouse. We shall use the convention of using **m** to designate the head and **f** the spouse. The analysis of Part 1 can be extended by positing a family utility function, $U = U(X, L_m, L_f)$ where the “family” jointly consumes corn X and derives utility from the leisure times of the two members. When a household head becomes disabled, it can affect family income and utility through its impact on the head’s wage W_m , time endowment T_m , or preferences.⁹ A change in the **health** status of the head will reduce the family’s full income and the shadow wage of the spouse \hat{W}_f . In a first approximation, a decrease in the head’s stock of **health** capital will raise the labor force participation rate of spouses and increase the work hours, $H_f = (T_f - L_f)$ of spouses already in the labor force. The size of this labor supply response depends on the magnitudes of income and substitution elasticities. A formal model can be found in Oi (1978). However, in a second approximation where the head and spouse allocate time to work H , internal home production I including the production of health capital and maintenance of the human agent, and leisure L , $[T_f = (H_f + I_f + L_f)]$, disability can be accompanied by a reduction in the labor supply of the spouse because more time is allocated to assisting and caring for the partner with a disability.

When **disability** is determined by a self assessment, Johnson and Lambrinos (1985) correctly argue that disability is an endogenous state. Unobservable variables will affect the self selection of persons who choose to be classified as **disabled**. Cornwell and Rupert (1991) advance the proposition that marital status should be treated as an endogenous variable. People choose to become and remain married. Based on earlier studies, G.S. Becker (1977) reported that the probability of a divorce is increased by the occurrence of an unusual event, favorable or unfavorable. Paula Franklin (1977) found that the onset of a disability is often accompanied by a divorce and a change in the family structure. It is a comparatively simple task to construct a

model in which labor supply, disability, and marital status are jointly endogenous variables, a far harder job to design a model that can be empirically implemented.

E. Public Income Transfers and Work Incentives

Up to now, non-wage income Y was assumed to be exogenous, which is surely violated in the real world. Many individuals are eligible for private and social disability insurance programs that will provide medical care and benefits if they become disabled. The Department of Veteran Affairs provides possibly the simplest disability insurance program. The individual is evaluated and given a "rating" entitling him or her to a monthly stipend and medical care. It imposes no "work test" but provides an increment to non-wage income which ought to expand the demand for leisure. Programs administered under State Worker Compensation Laws or Social Security involve more complicated labor supply responses because they require waiting periods and impose earnings tests. A person has to estimate the extent of his loss of health capital, the duration of the impairment, the odds for recovery, etc. These variables affect his productivity and discretionary time endowments which determine **the** potential earnings loss due to the limitations caused by the impairment. The decision to apply for disability benefits depends on the estimated size of the potential earnings loss, expected benefits incorporating the probability of qualifying for benefits, and the application costs. The last component must include both the explicit costs for medical verification and legal counsel as well as the implicit time and psychic costs incurred by the applicant. The expected returns from applying for disability benefits will be a function of age, the severity of the functional limitations and the particular impairments which serve as proxies for the odds of dying and recovering. Program application costs are considerably higher for the permanent total disabilities covered by SSDI when compared to applying for temporary total disability benefits under Worker Compensation.

From 1967 to 1973, benefit levels were raised and qualification standards relaxed resulting in a rapid growth in the number of SSDI beneficiaries. According to Parsons (1980) and Leonard (1986), the decline in the labor force participation rate of older men could largely be explained by the expanded work disincentives provided by a more generous Social Security Disability Insurance program.¹⁰ The constraints created by earnings tests and waiting periods produce corners and edges. The constrained maximum of utility is more likely to be attained at a corner. The policymakers face the difficult trade-off between providing an adequate benefit level for income maintenance for persons truly unable to work and supplying the proper incentives to remain employed for individuals with moderate disabilities.

The total family incomes in 1972 of households with male heads obtained from the Michigan Panel Survey of Income Dynamics (**PSID**) are shown in panel 2 of Table 5. An indication of the sampling variability can be gleaned from the sample sizes shown in panel 1. For the entire sample, the mean family income of men who were moderately disabled, the **M** group, was 79.0 percent of the never disabled men, the **B** group taken as the base group. Men with severe disabilities had incomes that were only 48.6 percent of the B group; see panel 5 for these indexes. These comparisons exaggerate the loss in family income because single and non-white men who earn lower wages even when healthy are more heavily represented in the M and S groups. When measuring well-being by either total family income or the labor income of the head, the P group (previously disabled but not disabled in the survey year 1972) is not

appreciably different from the moderately disabled group. Panel 4 suggests (but by no means convincingly shows) that households in the two disability groups, M and S, have higher “other incomes” which are generated by the labor incomes of spouses and transfer payments, public and private.

In data not shown here, we found that 54.9 percent of the wives of never disabled men, group B, were employed in 1972 and supplied an average of 1,211 hours a year. The wives of the 150 men with moderate disabilities had a 14 percent higher labor force participation rate and worked more hours a year. However, spouses of the men with severe disabilities revealed a lower LFPR, 38.3 percent, but those who worked supplied 1,538 hours. Transfer payments from social insurance and welfare programs made up only 1.7 percent of the family incomes of never disabled men, but they accounted for 29.1 percent of the family incomes of men with severe disabilities. These transfers are almost exclusively paid to men who withdrew or were prevented from participating in the labor force. Further analyses of the Michigan PSID data could be conducted by extending the sample period and examining the effects of age, schooling, and work experience. The SIPP data analyzed by **Alberto Martini** (1990) may prove to be more illuminating because it provides more detailed information on the number and severity of functional limitations and includes data on impairments and chronic conditions.

V. Demand for Workers with Disabilities

In a competitive market, the forces of demand and supply jointly determine employment and wages. Previous studies have almost entirely **focussed** on the impact of disability on labor supply, a research strategy which we have also followed in the preceding three sections. The demand for the labor services from individuals in a particular group will depend on its price (the wage rate), labor quality, any associated costs of employing workers, supplies of cooperating inputs, and technology. The issue of labor quality or **productivity** has to be addressed in any study of labor demand. Most employers have to incur hiring and training costs to assemble and maintain a work force. These employment costs are not the same for all workers. For instance, the University of Rochester pays the moving costs for all new faculty members irrespective of where they are presently living. Investments in workplace accommodations ought to be analyzed as just another associated employment cost. The presence of wage subsidies provides the employer with an incentive to favor hiring the subsidized employee. Insurance and tax policies currently provide such subsidies. Finally, we review some of the scanty evidence on the extent of employment and wage discrimination against individuals with disabilities.

TABLE 5
Family Income of Households with Male Heads, 1972
 [Michigan Income Dynamics Panel, **Male Heads 25-64 Years Old**]

	Entire Sample	White		Non-White	
		Married	Single	Married	Single
1. No. of Households					
A. Total	2,790	1,760	141	771	118
B. Never Disabled	1,864	1,238	86	448	52
M. Moderately Disabled	238	150	16	60	12
S. Severely Disabled	197	81	14	81	21
P. Previously Disabled	491	291	25	142	33
2. 1972 Total Family Income					
A. Total	12,473	14,589	9,831	9,264	5,044
B. Never Disabled	13,690	15,517	11,660	10,222	6,093
M. Moderately Disabled	10,822	13,324	7,815	6,569	4,829
S. Severely Disabled	6,648	8,398	5,422	6,069	2,948
P. Previously Disabled	10,993	13,016	7,300	8,936	4,802
3. 1972 Labor Income, Head					
A. Total	8,750	10,280	7,906	6,174	3,773
B. Never Disabled	10,013	11,286	10,043	7,287	5,240
M. Moderately Disabled	7,000	8,596	6,143	3,966	3,366
S. Severely Disabled	2,014	2,933	12,083	1,530	827
P. Previously Disabled	7,504	8,911	5,391	5,929	3,482
4. Other Income/a.					
A. Total	4,309	1,925	3,090	1,271	3,723
B. Never Disabled	4,231	1,617	2,935	853	3,677
M. Moderately Disabled	4,728	1,672	2,603	1,463	3,822
S. Severely Disabled	5,465	4,139	4,539	2,121	4,634
P. Previously Disabled	4,105	1,909	3,007	1,320	3,489
5. Index of Family Income/b,					
M/B	79.0	85.9	67.0	64.3	79.3
S/B	48.6	54.1	46.5	59.4	48.4
P/B	80.3	83.9	62.6	87.4	70.8
6. Index of Labor Earnings/b.					
M/B	69.9	72.7	61.2	54.4	64.2
S/B	20.1	24.8	12.8	21.0	15.8
p/B	74.9	75.4	53.7	81.4	66.5

- a. Represents **income from other family members** including spouse, **asset** income, and transfer incomes, Obtained **as** the difference between family income (panel 2) and labor income of **head** {panel 3}.
- b. Indexes represent **the** ratio of income for the particular disability state (**M,S,P**) to income for the never disabled **B** group expressed as a **percentage**. An index **value** of 100.0 indicates that the income is the same as that of the benchmark never disabled men.

A. Productivity and Essential Functions

A job match is made, and an employment relation is established when an employer offers a position to an individual who, in turn, accepts it. The job-search literature models the process as one in which an unemployed person or a new entrant to the labor force goes from firm to firm until he or she finds a suitable job offer. G.J. Stigler (1961) assumed that the individual sampled from a distribution of wage offers and adopted a stopping rule wherein search ceased when the cost of another “draw” exceeded the incremental expected return. The focus on the **wage** is an analytic convenience; the worker is looking for a position with the highest utility including both its wage and associated working conditions. According to Alfred Marshall (1920),

“In those yearly hirings which still remain in some parts of England, the laborer inquires what sort of a temper his new employer has, quite as carefully as what rate of wages he pays.” [p. 566]

Search is surely reciprocal; workers seek high wages, and employers interview job applicants to find the most highly qualified. N. Pissarides (1975) had a fixed-wage model in which a firm set a fixed wage and interviewed applicants and hired the first one whose qualifications equaled or exceeded its hiring standard. Other employers may adopt a stopping rule strategy, namely keep interviewing until the cost of another interview exceeds the expected gain of finding a more productive worker. The applicant, disabled or non-disabled, has to persuade the employer that he or she has the productive capacity to perform the necessary tasks.

In Section 1630.g of the Regulations, the ADA adopts a three pronged definition. The first prong states that a person has a **disability if** he or she has “...an impairment that substantially limits one or more of the major life activities of such individuals”. Whether the substantial activity limitation or limitations affect the capacity to do the work is to be determined by the concept of “a **qualified** person with a disability”. This qualification is to be determined in two steps: (a) whether he or she has the requisite skills, experience, education, licenses, etc., (b) whether he or she can perform the **essential functions** with or without accommodations. The Equal Employment Opportunities Commission has apparently embraced a fuzzy criterion, namely a threshold hiring standard that will be determined by the **essential functions** of the job.” If a job is narrowly described, (e.g. proofreading aloud, lifting, etc.), it will be easier to ascertain if a person is qualified. The “interpretative Guidance” contained one example in which an applicant might be asked if he or she had a driver’s license because in some exceptional instances, he might be asked to drive. **If** driving is a **marginal function** of the main job, and if there are a sufficient number of other employees with licenses among whom to distribute any driving chores, the employer could not deny employment because he had no driver’s license. The set of **essential functions** associated with a job will be smaller, the larger is the size of the employer’s work force. **If** a clerk at a garden store is occasionally required to lift 100 pound bags of fertilizer, **lifting** would be **essential** for a store hiring only two clerks but not for a store with twelve clerks. If a requirement is defined by a workload (e.g. typing 75 words a minute or standing for 8 hours), the employer must demonstrate that the standard was not set to exclude a person with a disability. The civil rights approach advanced by the ADA will hopefully increase the demand for workers with disabilities by reducing discrimination. It is, however, important to **examine the phrase**, “with or without **accommodations**”.

B. Accommodations and Labor Productivity

Investments in hiring and training a work force or in improving the quality of the work site are voluntarily made by the employer because they raise labor productivity and reduce the *full* cost of the labor input. Becker (1964) and Oi (1962) argued that if training increases productivity in all employments, its costs will be borne by the worker who receives a lower wage during the training period. If, however, the increased productivity is firm-specific, Hashimoto and Yu (1979) showed that it is optimal to share the costs. According to the EEOC regulations,

“In general, an **accommodation** is any change in the work environment or the way things are customarily done that enables an individual with a disability to enjoy equal employment opportunities (a) .. in the application process, (b) .. that permit the person to perform the **essential functions** and (c) .. to enjoy equal benefits and privileges of employment as are enjoyed by employees without disabilities.”

An employer would have voluntarily made the accommodation if it raised the individual's productivity by more than the cost. With the passage of the Americans with Disabilities Act, the decision is no longer left to discretion but is instead imposed as an obligation.

“[covered] Employers are required to make **reasonable accommodations** to the known physical or mental limitations of an otherwise **qualified** individual unless to do so would impose an undue hardship.”

The effect on demand will depend on what is construed to be a **reasonable accommodation** and what penalties are placed on employers for **non-compliance**.¹² The undue hardship defense favors the smaller employer with a shallow pocket. The burden of providing jobs for the disabled is likely to be borne by the large employers who both have the wherewithal to assume the accommodation costs and who have big enough work forces to reduce the number of **essential functions** that have to be performed by qualified persons with a disability. If job restructuring and part-time and part-year work schedules are accepted as **reasonable accommodations**, the employer faces a difficult problem in the equitable treatment of all employees. In most **firms**, part-time employees are paid at a lower hourly rate than full-time employees in the “same” job. The hourly wage discount for part-time work is larger in manufacturing industries, but it is still observed in sales, service, and clerical occupations because the part-time employee typically receives less “on the job” training, has less work experience, and is asked to perform fewer tasks than his/her full-time counterpart. The existing part-time wage discounts would thus seem to reflect a compensating difference reflecting the lower productivity of the part-time employee. If persons with disabilities need modified work schedules because of their physical/mental impairments, should they be **entitled** to the same pay as full-time employees? The correct answer is in the negative if we want to deter persons without disabilities who want to hold part-time jobs from claiming that they are disabled to avoid the part-time wage discount. In short, accommodations that affect worker productivity should be accompanied by compensating wage differences.

There are at least two serious problems with this civil rights approach to disability policy.. First, it forces employers to adopt a **satisficing** employment policy. A qualified person with a

disability who needs only a **reasonable accommodation** has as much right to a job as any other job applicant. The employer is discouraged from searching for the most highly qualified individual. The efficiency loss from such a satisfying strategy might be small if the variance in performance across job applicants is small. **If**, however, the variance is large, (as it is perceived to be when recruiting for a highly skilled position), an obligation to accept an applicant who meets the minimal job requirements could result in a significant opportunity cost to the employer. Second, **disability** is not an easy state to **define** or determine. The **essential functions** which have to be performed can vary depending on the size of the work force and the nature of the job. The efficacy of **reasonable accommodations** is uncertain. The legislation and the enforcement agencies cannot promulgate clear cut guidelines. The Americans with Disabilities Act is intended to establish a process.

“This case by case approach is essential if qualified individuals with varying abilities are to receive equal opportunities to compete for an **infinitely** diverse range of jobs. For this reason, neither the ADA nor this regulation can supply the correct **answer** in advance for each employment decision concerning an individual with a disability.”

The intent of the Act is to promote employment by placing an obligation upon **covered employers** to make job offers to **qualified** persons with a disability and to provide them with **reasonable accommodations**. Failure to do so puts the employer in a position where he or she can be sued for discrimination. Enforcement of the law is likely to be left to civil **litigation**.¹³

C. Implicit and Explicit Wage Subsidies

A wage subsidy can expand employment for members of a target group. Policies of this kind have been tried to reduce unemployment among teenagers. The Targeted Job Tax Credit program (TJTC) was implemented to promote employment for certain disadvantaged groups including persons with disabilities. TJTC is an explicit wage subsidy which reduces the net labor cost if the firm elects an individual who is eligible for tax credits.

Vocational **rehabilitation** could be viewed as an implicit subsidy in the sense that the public sector assumes the costs of retraining a person with a disability. The relative size of these outlays (in relation to either the wages bill or the cost of living) has declined in the last fifteen years. The larger implicit wage subsidy is incorporated in the Worker Compensation program. A covered employee who becomes totally disabled (permanent or temporary) is eligible for weekly benefits whose size varies across states. Most employers with 500 or more employees are self insured meaning that the weekly benefits to the employee with a disability is a direct cost to the firm. Suppose that before the disabling injury, the employee had been earning a weekly wage of $W_0 = 500$ dollars and that the mandated weekly benefit under Worker Compensation was $B = 200$ dollars. The **firm** is obliged to pay B irrespective of whether the worker does or does not return to work. The **net wage** which the **firm** has to pay this worker with a disability is not the pre-injury wage of $W_0 = 500$ dollars, but rather the wage less the Worker Compensation benefit; i.e. the post-injury cost of this employee is $W_1 = (W, -B) = 300$ dollars. For a self-insured employer, the benefits paid under Worker Compensation provides the firm with an incentive to return the worker with a disability to the firm's payroll even though he or she is

unable to be as productive as before the injury. It pays to hire this particular individual with a disability if his or her marginal value product exceeds the net wage W_1 of the implicit wage subsidy. This incentive is absent for the small employer who is *not* self insured. This implicit wage subsidy, taken by itself, ought to raise the ratio of disabled to non-disabled workers in large, self-insured firms.

The effectiveness of wage subsidies in promoting employment depends on the elasticity of demand and the extent to which the disabling condition has affected an individual's productivity. We need to study the TJTC program to determine the effect of explicit subsidies. The employer costs of disabling workplace injuries vary according to whether the employer pays a flat rate, is experience rated, or is self insured. Under the last two arrangements, which are only available to large firms, an employer is provided with an implicit wage subsidy (via lower Worker Compensation costs) if a former employee with a disability can return to work. No studies have seen that try to quantify the strength of this implicit incentive.

D. Wage and Employment Discrimination

The reports of the House and Senate Committees which summarized the hearings preceding the passage of the Americans with Disabilities Act concluded that there was widespread discrimination against people with disabilities. We cite some of their **salient findings**:

- Historically, society has tended to isolate and segregate individuals **with** disabilities, .. and such discrimination continues to be a serious and pervasive social problem.
- Discrimination ..**persists in** such areas as employment, housing, public accommodations, education, transportation.
- Unlike race, color, sex, .. individuals who face discrimination on the basis of disability have often had no **legal** recourse to redress such discrimination
- Census data .. have documented that people with disabilities as a group occupy an inferior status in our society and are severely disadvantaged.
- The nation's **goals** are to assure equality of opportunity, **full** participation, independent living, and economic self sufficiency.

These findings were mainly supported by testimony involving cases in which individuals were denied access to places, housing, and most importantly to jobs because of their disabilities. The evidence is persuasive, but it does not allow us to estimate the aggregate social cost of discriminatory employment practices.

Over two-thirds of working age adults with disabilities are either out of the labor force or unemployed. Some individuals with severe disabilities are simply unable to do any work. Others with a small stock of discretionary time or a short remaining working life may choose to voluntarily withdraw from the labor market. The authors have come across only two studies that try to estimate the extent of **involuntary** non-employment. One-third of the respondents to the

1983 Health Interview Survey (HIS) and 44 percent of the respondents with disabilities to the 1985 Lou Harris poll (conducted for the International Center for the Disabled) who were not working indicated that they wanted to work. The reasons are not known for their inability to find work --- employer ignorance about their productivity, lack of training or schooling to qualify for the job, unwillingness to provide the workplace accommodations needed to realize the full productivity of the worker with a disability, or discriminatory hiring practices. It cannot be told whether the respondent truly *wanted to work* or said what he or she thought that the interviewer wanted to hear. Diane Robinson Brown (1989) cross-tabulated the HIS data and found that persons with three or more functional limitations indicated a far stronger preference for working than individuals with only one or two limitations. A further analysis of the data from the Health Interview Survey may permit an estimate of the fraction of those desiring work who are capable of performing the essential functions of the jobs desired.

The task of determining whether a worker with a disability receives “equal pay for equal work” is a more tractable problem. William Johnson and James Lambrinos (1985) specify a wage equation wherein the logarithm of the hourly wage denoted by W was related to a vector of eight explanatory variables X .¹⁴ Since only a minority of working age adults with disabilities were employed in the 1972 Survey of Disabled and Non-Disabled Adults, they included an inverse Mills ratio λ to correct for the selectivity bias. The wage equation which they estimated was,

$$(4.1) \quad W = X\beta + \lambda\gamma + e.$$

The parameters were estimated by least squares for two samples, non-handicapped and handicapped workers.¹⁵ Let $\{W, X_1, \lambda_1\}$ denote the sample means of the variables for the non-handicapped workers, while $\{W, X_2, \lambda_2\}$ are the means for handicapped employees. The difference in wages was decomposed into three terms.

$$(4.2) \quad [W_1 - W_2] = X^*[B_1 - B_2] + [X_1 - X_2]B^* + [\lambda_1 c_1 - \lambda_2 c_2]$$

where the asterisks are averages for the two samples.¹⁶ The third term is that part of the difference due to different selectivity bias corrections. The second term represents that part of the difference in offer wages due to different “endowments”. Thus, if non-handicapped workers are, on average, more highly educated, as the data do indeed show, they ought to realize higher wages. However, non-handicapped workers are less likely to be employed in the public sector where wages are, on average, higher.”

When these differences in endowments or traits between the two groups are weighted by the average returns or “prices” B^* , we get that part of the wage differential due to the fact that the handicapped worker brings to the labor market a different basket of traits. The **first** term, $X^*(B_1 - B_2)$ is interpreted as the effect of labor market discrimination on the earnings differential. J. & L. estimated that another year of education added .054 to the log of hourly earnings for a non-handicapped worker but only .040 for a handicapped employee. The coefficients for the race dummy variable were -.149 and -.162, meaning that being disabled and black expanded the offer wage differential by 1.3 percent. J. & L. estimated that 15.2 points of the 44.5 percent offer

wage differential suffered by handicapped workers could be attributed to labor market discrimination.

The authors could be persuaded that this is an unbiased estimate if (a) the wage equation (4.1) was correctly specified, and there are no important omitted variables, (b) the hourly wage is the appropriate "price" for labor services as it would be in a spot labor market, and (c) the explanatory variables in the X vector are homogeneous across the two samples. Appendix A, examines the validity of the decomposition methodology and conclude that the J. & L. estimate overstates the impact of labor market discrimination on the wages of workers with disabilities. Some employers may be practicing wage discrimination against workers with disabilities, but the extent of that discrimination cannot be measured **with** the methodology proposed by Reimers (1983).

VI. Rights to Equal Employment Opportunities

Bennefield and McNeil (1989) reported that in 1988, only 27.1 percent of working age adults with a work disability were gainfully employed compared to 74.4 percent of adults without disabilities. Even when they found employment, people with disabilities realized lower annual earnings because they worked fewer weeks a year, were more likely to hold part-time jobs, and received lower hourly **wages**.¹⁸

These empirical regularities can be explained in part with the aid of a static labor supply model developed in Section II. It is agreed that a disability limits an individual's ability to perform tasks, but in addition, the authors advance the thesis that disability steals time. Persons with disabilities have to allocate more time to maintenance of the human agent and, hence, have smaller endowments of discretionary time for work and leisure. Some withdraw from the labor force, and others seek work schedules calling for short hours or flexitime schedules.

Most researchers prefer to define **disability** in terms of functional limitations which can, in principle, be traced to underlying impairments. In Section III, it is argued that the **interactions** between functional limitations and impairments are important in assessing the **impact** of disability on work capacities. Only a small minority of all disabilities are congenital. The vast majority become disabled at older ages and must adjust to the changed circumstances. Moreover, some disabilities are only temporary, and upon recovery, these individuals could conceivably return to their previous jobs and life **activities**. The dynamics of the adjustments to the onset of disability are explored in Section IV where the way a shorter life expectancy due to a disabling impairment might affect labor supply is examined. The labor supply responses of other family members, including the possibility of a marital dissolution, and the work disincentives which often accompany the receipt of transfer payments also operate through the impact of disability on the supply side of the labor market.

On the demand side, discrimination by employers or fellow employees and consumers could result in a situation where persons with disabilities have greater difficulty in finding suitable jobs and/or are paid lower wages. Title I of the Americans with Disabilities Act (ADA) is intended to prevent such discrimination.

“A covered entity is prohibited from discriminating against a **qualified individual with a disability** in regard to job application, hiring, discharge, compensation, training, or other terms, conditions, or privileges of employment. Employers are required to make **reasonable accommodations to** the known physical or mental limitations of an otherwise qualified individual unless to do so would impose an **undue hardship.**”

The language is nearly identical to that in section 503 of the Rehabilitation Act of 1973. Both pieces of legislation, the Rehabilitation Act and the ADA, treat people with disabilities as though they constituted an identifiable minority like race or gender. The welfare of the disabled will presumably be improved by mandating equal employment opportunities.

Disability is not like race or gender. A person with a disability is by definition **substantially limited** in performing one or more of life's major activities. He or she may thus not be qualified to **fill** any given job vacancy. Indeed, some individuals without disabilities might not be qualified. The essential functions of the job have to be identified to determine if the person with a disability is qualified. If an accommodation is needed to perform the essential functions, the employer has to provide it unless it is too costly. Enforcement and litigation costs are likely to be high for two reasons. First, there is an elastic supply of potentially disabled persons. Second, disputes are sure to arise about what are the **essential functions** of a job and what constitutes a **reasonable accommodation**. The regulations issued by the Equal Employment Opportunities Commission explicitly state that these matters have to be decided on a case by case basis because disabling conditions **and the** requirements of the job can change from day to day or from place to place. The ADA is also silent about pay. If a job has to be restructured or work schedules shortened to accommodate a person with a disability, is the **firm** obliged to pay him or her the same wage as a worker without a disability who confronts different working conditions?

The capacity and willingness to work clearly depend on health status. Based on a survey in April 1985, S. Cohaney (1987) reported that 95.8 percent of Vietnam-era veterans with **no service connected disabilities** were employed compared to only 79.9 percent of veterans with disabilities. The percentage who were gainfully employed was inversely related to the disability rating determined by the Veterans Administration; 92.2 percent of those with a rating of under 30 percent were working, 79.5 percent for ratings of 30 to 60 percent, and only 34.5 percent of veterans with disability ratings of over 60 percent. From a policy perspective, it can be assumed that labor productivity is unrelated to race or gender. The same assumption is untenable for people with disabilities. The nature and severity of the disability varies widely. Most become disabled at older ages and must be retrained for the usual activities of daily living or working. Many of them who become disabled near the planned age of retirement may prefer to withdraw from the labor force. For them, as well as some who are severely disabled, the appropriate policy is one which provides a safety net of income maintenance and medical care.

Haveman and Wolfe (1990) have assembled data showing that the well being of the persons with disabilities has deteriorated in the last 25 years. The earnings of workers with disabilities have declined relative to those of able-bodied workers. These trends confound the effects of transfer payments and labor market discrimination. Title I of the ADA tries to deal

with employment. It has to be evaluated in the context of other actions which promote employment such as job training, better placement services, and various wage subsidy programs. Employment is important, but it has to be incorporated into a larger disability policy which provides for vocational and medical rehabilitation and income maintenance for those who are unable to work. Jane West (1991) argues that the Americans with Disabilities Act is only the **first** step in moving people with disabilities into the mainstream. Ours is a more modest endeavor which tries to incorporate disability into a model of a labor market for individuals with disabilities.

Appendix A: Technical Notes

I. Note A: On Allocating Consumption and Leisure Time Over a Life Cycle

Following J.R. Hicks, (1947) we assume that an individual chooses flows of a consumption good and leisure time $\{X_j, L_j\}$ to maximize an intertemporal utility function, $U_0 = U(X_1, X_2, \dots, X_N, L_1, L_2, \dots, L_N)$ subject to the budget constraint,

$$(A.1) \quad \Sigma B^j X_j = \Sigma B^j W_j (T_j - L_j) + Y_0 \quad [j = 1, 2, \dots, N]$$

where $B = 1/(1+r)$ is the discount factor, W_j is the expected wage in period j , and Y_0 is the individual's wealth (positive or negative) at the start of the remaining life horizon taken to be period 0. Given $[B, W_j, T_j, Y_0]$, the individual maximizes U_0 subject to (A.1) and N implicit non-negativity constraints, namely $(T_j - L_j) \geq 0$. Suppose that an individual retires at the end of period R . Up to that age, the marginal rate of substitution of X for L is equated to the wage.

$$(A.2a) \quad (U_{L_i} / U_{X_i}) = W_i \quad [i = 1, 2, \dots, R]$$

When an individual retires, it means that the utility maximizing supply of labor is zero. The MRS of X for L is equated to a shadow wage which exceeds the market wage.

$$(A.2b) \quad (U_{L_j} / U_{X_j}) = \hat{W}_j > W_j \quad [j = R+1, R+2, \dots, N]$$

where we assume that he retires, and remains out of the labor force.' If market wages and work hours follow smooth paths, earnings will exceed consumption, and savings will be positive up to some period S . Beyond that period, dissavings will reduce the individual's stock of wealth. This is what Blinder and Weiss (1976) assumed in their life cycle model. Recall that in our model, the individual is initially observed at time 0 and has a remaining life of N periods. If he is already dis-saving, S is undefined, and if retired, R is also **undefined**.²

The onset of a disability can affect an individual's time endowments in two ways. First, it can reduce the discretionary time endowment in each period, $T' < T_j$ where the prime indicates the post-disability time endowment. In addition, the disability can contract the length of the life cycle to $M < N$ periods. The equilibrium which prevailed before the onset was described by equations (A.2a), (A.2b), and the budget constraint (A.1) which can be rewritten as follows:

$$(A.3) \quad \Sigma B^j X_j + [B^1 L_1 + \dots + B^R L_R] + \{B^{R+1} L_{R+1} + \dots + B^N L_N\} = F$$

where F is **full income** defined by,

$$(A.3') \quad F = [B^1 W_1 T_1 + \dots + B^R W_R T_R] + \{B^{R+1} \hat{W}_{R+1} T_{R+1} + \dots + B^N \hat{W}_N T_N\} + Y_0$$

i.e., in defining full income shadow wages replace market wages once the individual elects to retire. If the disability reduces the discretionary time endowment in each period, full income is

reduced. Shadow wages will rise pushing some persons with disabilities out of the labor force. The results are akin to those discussed in Section IV (A) and IV (B).

To analyze a disability that shortens the individual's life, we initially assume that market wages and discretionary time endowments in each period remain unchanged. Two cases can be examined. First, $R < M$ meaning that the end of the life cycle occurs beyond the preferred pre-disability retirement age. A reduction in the length of life displaces the budget constraint (A.3) because $[X_{M+1}, X_{M+2}, \dots, X_N]$ are now equal to zero. The individual can now consume more corn, possibly in the form of a bequest. As X_j is expanded, the MRS of X for L climbs resulting in an earlier retirement age R. In the second case, $R > M$ meaning that death occurs before the preferred retirement age. If we let asterisks denote the post-disability demands for corn and leisure, the person with a disability maximizes, $U^*_0 = U(X^*_1, \dots, X^*_M, L^*_1, \dots, L^*_M)$ subject to the budget constraint,

$$(A.1^*) \quad \Sigma B^j X^*_j = \Sigma B^j W_j (T_j - L^*_j) + Y_0.$$

The optimal retirement age R^* will now be less than M meaning a decrease in the lifetime supply of labor to the market. If the disability also reduces the individual's market wages and discretionary time endowments, the decrease in earnings and work hours will be further reinforced.

II. Note B: A Measure of the Extent of Wage Discrimination

William G. Johnson and James Lambrinos (1985) adopted a methodology proposed by Cordelia Reimers (1983) to estimate the wage discrimination experienced by handicapped workers. The procedure is based on the earlier work of Ron Oaxaca (1973) and begins with a wage equation.

$$(B.1) \quad W = X\beta + e$$

where W is the vector of sample observations on the log of the hourly wage, X is a matrix of explanatory variables such as education, experience and its square, marital status, etc., and e is the random disturbance vector. Although a majority of all adults work, some prefer to remain out of the labor force. Define an index P which is related to a set of explanatory variables Z, the determinants of work status.

$$(B.2) \quad P = Z\alpha + u$$

An individual is employed and earns a positive hourly wage if $P = Z\alpha + u > 0$, or $Z\alpha > -u$. An inverse Mills ratio λ can be constructed from the residuals of (B.2) and included in the wage equation to adjust for the selectivity bias. We thus get the augmented wage equation.

$$(B.3) \quad W = X\beta + \lambda\gamma + v$$

Suppose that the parameters of this wage equation are estimated by least squares for a sample of the dominant group, males or persons without disabilities yielding the parameters, $\{B_1, c_1\}$. The estimation is repeated for a second group, say females or workers with disabilities yielding $\{B_2, c_2\}$. Let $\{W_j, X_j, \lambda_j\}$ denote the means of the variables for the j^{th} sample. The measured residual v will be identically equal to zero when we take means. Thus, we get,

$$(B.4) \quad W_1 = X_1 B_1 + \lambda_1 c_1. \quad W_2 = X_2 B_2 + \lambda_2 c_2.$$

The difference in sample means between the workers without disabilities and workers with disabilities is initially divided into two parts.

$$(B.5) \quad [W_1 - W_2] = [X_1 B_1 - X_2 B_2] + [\lambda_1 c_1 - \lambda_2 c_2].$$

the component of the predicted wage attributable to the observed variables in the wage equation is called the offer wage, $Y_1 = X_1 B_1$, while the other component resulting from the selection into the work force, $S_1 = \lambda_1 c_1$ can be called a selection correction. The observed difference in mean wages can be decomposed into a difference in wage offers and a difference in selection corrections. The wage offer differential, $(Y_1 - Y_2)$ can be broken into a term due to differences in traits and a term due to a difference in parameters. More precisely, we have,

$$(B.6a) \quad Y_1 - Y_2 = [X_1 - X_2][k B_1 + (1-k) B_2] + [(1-k) X_1 + k X_2][B_1 - B_2]$$

$$(B.6b) \quad Y_1 - Y_2 = [X_1 - X_2] B^* + X^* [B_1 - B_2]$$

where $0 < k < 1$ is an arbitrary weight. The **first** term, $(X_1 - X_2) B^*$, measures that part of the total offer wage differential due to a difference in “endowments”. **If workers** without disabilities are better educated, have more work experience, or more likely to be married than the employees with disabilities, they can be expected to earn higher wages because all of these variables have positive coefficients in the wage equation. Johnson and Lambrinos interpret the second term, $X^* (B_1 - B_2)$, as a measure of labor market discrimination. The thought experiment is to imagine a worker with average endowments X^* . **If** he were paid the “returns” given by the non-disabled wage equation, his mean offer wage would have been $Y_1 = X^* B_1$, but if he had been paid according to the equation for an employee with a disability, his mean offer wage would have been $Y_2 = X^* B_2$. **If** $B_1 > B_2$, it is concluded that there is market discrimination against the persons with disabilities because they receive a lower “return” for the same endowment.

The validity of this procedure rests on several assumptions. First, the wage equation is correctly specified and there are no major omitted variables. Second, the hourly wage is the appropriate “price” for labor services. The presumption is that we have a spot market for labor and implicit, long-term contracts are unimportant. Third, the model tacitly assumes that the endowments or traits in the X matrix are homogeneous across samples. An additional year of experience or another year of schooling represents the *same* increment to human capital. A lower return paid to an employee with a disability is interpreted as a lower “price” due to employer discrimination. If workers with disabilities are more likely to hold jobs with part-time or short work schedules, an additional year of work represents a smaller addition to accumulated work

experience relative to another group of workers who usually hold full-time jobs. The coefficient of years of experience will be smaller which reflects the non-homogeneity of **experience** rather than **discrimination**. In any one-digit occupation, there is a wide dispersion of jobs that are associated with very different working conditions and skill requirements. We should expect to observe different coefficients for this occupation's dummy variable except for the unusual case where the workers in each group exhibit the **same** "within occupation" distribution of detailed occupations.

To sum up, we believe that it is misleading to measure the extent of wage discrimination by the difference in "prices", $X*(B_1-B_2)$. The wage equation could easily be mis-specified. Hourly wages are indicative but not fully accurate measures of the returns to jobs involving implicit, long-term employment relations. The right side variables in a wage equation are not always homogeneous across samples. This heterogeneity will be reflected in differences in parameters that have nothing to do with discrimination.

Appendix B
A Review of Empirical Studies
on
Employment of Persons with Disabilities:
Key Findings and Data Considerations

I. Introduction

The text of this report discusses the empirical evidence and theoretical implications of the labor market outcomes for persons with disabilities. In so doing, it indicates how the Americans with Disabilities Act (ADA) may influence these outcomes. While a number of empirical studies are cited, a general review of the economic literature in this area is not provided. Appendix B fills this gap.

Section II offers a brief overview of key provisions of the ADA. Section III discusses specific measures of disability in greater detail, including several measures used to investigate trends in disability and impairment over time. Section IV reviews studies in three areas in which the ADA may have an impact: (1) labor force participation; (2) wage discrimination; and (3) the costs of accommodation. Other studies reviewed in Section V focus on a more narrowly defined definition of disability. Section VI evaluates the research described above and indicates directions that should be taken in the future.

To summarize, we suggest that future studies related to the ADA need to be based on current data as many changes have taken place in the labor market in recent years. Research studies should also provide more specific information on the health conditions and types of impairments that cause the work disability. Some conditions require greater investments in health capital, while others reduce life expectancies. Different impairments also affect worker productivity and costs of accommodation in different ways. Furthermore, job restructuring and costly accommodations are generally more practical for larger **firms**. As a consequence, information on each of these aspects of the labor market is required to study the impact of the ADA.

II. A Brief Legislative Review

The ADA promotes a civil-rights approach towards the employment of individuals with disabilities. That approach precludes discrimination in the labor market and mandates reasonable accommodation. Under the ADA, individuals with disabilities face physical or mental impairments that substantially limit one or more major life activities; are persons with records of such impairments; or are persons regarded as having such impairments. Disabilities can be physiological (affecting any number of body systems), mental, or psychological. Individuals who have successfully finished drug or alcohol rehabilitation programs are also included. **Empirical investigations of the labor market impact of the ADA must identify persons with disabilities**

within this context. In comparison to other populations covered by civil rights legislation, the population affected by work disability is heterogeneous and complex.

Under Title I of the ADA, employers are forbidden to discriminate against qualified individuals with disabilities in their hiring, advancement, and compensation. Discrimination is also precluded with regard to job application procedures, training, and other conditions of employment. Thus, research on the ADA needs to estimate of the extent to which persons with disabilities face discrimination in the labor market.

Under Title I of the ADA, employers are required to provide reasonable accommodation in the workplace to enable individuals with disabilities to perform the essential functions of jobs for which they are qualified. Such accommodation, however, is not intended to create undue financial hardship for the employer. To address this issue, information should be available on the types and costs of accommodation provided by employers. Empirically, one would want to determine whether these costs are offset by gains in productivity or whether other elements of compensation are reduced instead.

III. Measuring the Prevalence of Work Disability

In the text of this report we note that work disability is higher among older persons and among persons with lower levels of education. Work by **LaPlante** (1988) which uses the Health Interview Survey (HIS) is cited. Other investigators have charted trends in impairment and disability over time. Two major studies based on different definitions of work disability use data from the Census Bureau's March Current Population Survey (CPS). **The** first study is by Burkhauser, **Haveman**, and Wolfe (1990)³ and the second is by **Bennefield** and **McNeil** (1989). Other researchers, Verbrugge (1984) and Crimmins and **Ingegneri** (1991), have used the HIS to study trends in health conditions and activity limitations. **The** 1984 Survey of Income and Program Participation (SIPP), which combines some of **the** detail found in the HIS with labor market information, has also been used to measure the incidence of work disability.

Burkhauser, Haveman, and Wolfe (1990) Burkhauser, **Haveman**, and Wolfe use Current Population Survey data from 1962 through 1988 to investigate trends in **disability** and earnings. "While their definition of disability varies somewhat according to survey year, they strive to maintain a consistent definition over time.

Their definition is based on program participation eligibility and on reported work limitations. In terms of program participation, Burkhauser, **Haveman**, and Wolfe include working-age individuals who receive Social Security Disability Insurance (DI) or Supplementary Security Income (SSI) in their own right. They also include those who receive workers' compensation or veteran's benefits. Individuals in school are not included. In terms of work limitations, Burkhauser, **Haveman**, and Wolfe include individuals who report they are unable to work at all, those who work part time because of illness, and those who are temporarily not at work because of illness.

Using this composite **definition**, Burkhauser, **Haveman**, and Wolfe find that the prevalence of disability rose from 10.5 percent in 1968 to 11.0 percent during the first half of the 1970s. The rate declined during the **1980s**. Burkhauser, **Haveman**, and Wolfe also report that the share of income stemming from earnings received by persons with disabilities decreased considerably over the years.

Bennefield and McNeil (1989) Bennefield and McNeil use a somewhat different definition of disability for the working age population using the same March CPS data for the period 1981 to 1988. They start with the two disability questions included in the CPS to screen respondents prior to asking about disability transfer-payment reciprocity. Individuals who report they did not work because of disability (based on two questions) are also included. Recipients of DI and SSI are counted. Unlike Burkhauser, **Haveman**, and Wolfe, those receiving workers' compensation and veteran's payments are not included. Bennefield and McNeil also separate out the seriously disabled by only counting individuals who are **DI** or SSI recipients or who reported they did not work at all because of disability or ill health (according to one of two questions).

Bennefield and McNeil report that in **1988**, **8.6** percent of the working age population had a work disability and 4.8 percent was severely disabled? Compared to **Haveman** and Wolfe, Bennefield and McNeil **find** somewhat lower rates of disability for men. For women, the disability rates calculated by Bennefield and McNeil **are** lower in 1982 and higher in 1988 relative to **Haveman** and Wolfe.

Bennefield and McNeil show that the labor force participation rate of men with a work disability declined from 41.9 percent in 1981 to 35.7 percent in 1988. By contrast, the participation rate for able-bodied men was 74.1 percent in 1981 and 74.8 percent in 1988. The labor force participation rate of women with a work disability rose from 23.5 percent to 27.5 percent. This increase parallels the gains in labor force participation made by women over the past three decades. For able-bodied women, labor force participation rose from 41.6 percent in 1981 to 47.1 percent in 1988.

Verbrugge (1984) Verbrugge (1984) uses the HIS to investigate trends in a great variety of health conditions and impairments over the two decades spanning 1960 through 1980. For instance, one series of questions in the HIS asks respondents whether they had health problems that limited them in a job or with housework. These are considered major activity limitations. Individuals are also asked about limitations in their secondary activities (such as participation in church and club activities or in shopping expeditions). Following these data over time, Verbrugge found increases in major-activity limitations and in secondary-activity limitations for men and women age 45 to 64.

The HIS provides information on the prevalence of specific chronic conditions such as hypertension, arthritis, chronic sinusitis, hearing impairments, and heart disease (the leading conditions for men). Prevalence rates can be linked to limitation rates so that the condition leading to the activity limitation can be specifically identified. For middle-aged persons, chronic diseases often do not **lead** to activity limitations_ Limitations result from impairments not related

to chronic conditions. In sum, the relationship between disability and health conditions appears to be complex.

Evidence compiled by Verbrugge suggests that these relationships also vary by age. Her data, which span the 1970s and 1980s, indicate that the percentage of individuals with activity limitations increases substantially for each age cohort. Furthermore, the percentage of each age group limited in activity due to a chronic health problem is considerably higher than the percentage who are unable to perform a major activity due to a chronic health problem.

Crimmins and Ingegneri (1991) Additional work by Crimmins and Ingegneri (1991) using the HIS discern no trend in the health status of middle-aged individuals in recent years. Their findings suggest that although health status declined somewhat during the 1970s, the 1980s represented a period of relative stability. These conclusions are based on the analysis of a variety of indicators over more than two decades.

Differences in Disability Measures In their Census Bureau report using CPS data, Bennefield and McNeil compute similar measures of work disability from other surveys. They indicate that the 8.6 percent work-disability rate for 1984 based on the CPS is lower than the 12.1 percent rate from SIPP or the 11.5 percent rate from the HIS for 1983-85. **They suggest that** the CPS figure underreports disability relative to other data sources because the SIPP and the HIS question respondents much more intensively than the CPS.

Martini (1990) compares disability rates from the SIPP to those constructed using other data bases. He indicates that according to the 1984 SIPP, **5.3** percent of the population are severely disabled compared to 4.6 percent of the population in the CPS, based on a comparable measure. He notes that the HIS and SIPP generate similar estimates of persons age 18 and older who are limited in activities of daily living (**ADLs**) and instrumental activities of daily living (**IADLs**). Large differences are found, however, when estimates of the number of persons with work limitations are constructed. Martini reports that this difference is probably due to the way in which the questions are ordered in the survey instrument, and the fact that the HIS is structured to exclude persons with temporary work limitations.

Martini notes:

SIPP first asks questions about limitations in functioning, then asks whether a person is limited in work, and then asks whether a person is unable to work. The context of the SIPP work limitation question might thus prompt respondents to answer with a preferred work situation whose attainment could be difficult. The SIPP question ordering seems likely to increase the number of persons who report work limitations. In contrast, **NHIS first** asks whether the respondent is unable to work, and then asks about any limitations in work. The question on work limitation is asked within the context of real-life work activity, which is likely to limit the number of **affirmative** responses.

In other words, the HIS series of questions appears preferable. Nonetheless, Martini's cross-section study of work and disability is based on the SIPP since the HIS does not contain information on earnings. (A 1990 HIS supplement on income and earnings, however, will be available in 1992.)

Summary The ADA incorporates a broad definition of disability. It does not restrict its focus to cases of severe disability that may qualify for federal assistance.⁶ Consequently, to assess the ADA, studies must focus on all persons with disabilities. Using either the HIS and the CPS, researchers can construct broad work-disability measures over time.

The HIS can be used to classify persons with disabilities by type of disability. The CPS provides a plethora of information on earnings, income, and program participation. The SIPP combines the many strengths of the CPS and the HIS, although the SIPP may overestimate the prevalence of disability. Furthermore, the SIPP data are only available for 1984.

IV. Studies of the Labor Market and Persons with Disabilities

Many issues must be involved in empirically assessing the labor market impact of the ADA. These include the extent to which disability steals time, the degree to which disability affects productivity, the prevalence of discrimination, and the cost of accommodation. Few empirical studies have addressed these issues using a broadly based definition of disability. Most empirical studies focus on the impact of income maintenance programs on persons with disabilities. Yet individuals who may be eligible for disability payments make up only a fraction of individuals with work disabilities as defined by the ADA.

Three studies address issues that are closely related to an evaluation of the ADA. The first investigates the impact of health on labor supply. The second focuses on wage discrimination among persons with disabilities. The third presents findings based on a survey of the costs of accommodation.

Grossman and Benham (1974): Grossman and Benham investigate the impact of health on hours worked using data from the 1963 HIS for 1,049 white men aged 18 to 64. They estimate three equations: a wage equation, a weeks-worked equation, and a health function. The health index is based on four health status variables using principal components analysis.

Grossman and Benham find that ill-health reduces wages and weeks worked in accordance with theoretical expectations. The study does not correct the wage equations for selectivity bias, however.

These issues are only part of the story. Other factors, such as the relationship between disabling condition and job qualifications, must be taken into consideration as well. While the Grossman and Benham study takes a broad approach to the issue of labor supply, their model would need to be updated and reestimated with current data.

Johnson and Lambrinos (1984): Johnson and Lambrinos provide the only estimate of the extent of wage discrimination against persons with disabilities. They use data from the 1972 Survey of Disabled and Non-Disabled Adults to estimate earnings functions for handicapped and **non**-handicapped men and women. The sample consists of 3,612 men of whom 951 had disabilities and 1,775 women, of whom 337 had disabilities. They use principal components analysis to construct a health index based on 34 variables, prior to running wage equations adjusted for selectivity bias.

Their analysis separates the impact of the included variables on wages from unexplained effects. They find that 29 percent of a 44-percent wage differential between disabled and **non**-disabled men was not explained. Similarly 45 percent of a 75-percent wage differential for disabled and non-disabled women is not explained. Johnson and Lambrinos attribute that difference to discrimination.

The extent of initial wage discrimination is one of the key issues in evaluating the future impact of the ADA. Johnson and Lambriuos implicitly attribute the impact of differences in rates of return to education and experience to discrimination. If their health variable does not capture all of the productivity losses due to disability, the unexplained difference cannot be exclusively attributed to discrimination. Consequently, their estimate of discrimination is likely to be too high.'

Berkeley Planning Associates (1982): The only study on the costs of accommodating workers with disabilities was conducted by Berkeley Planning Associates for the U.S. Department of Labor's Employment Standards Administration to evaluate the provisions of the 1973 Rehabilitation Act requiring federal contractors to accommodate handicapped workers. The study surveyed 2,000 federal contractors; responses were obtained from 367 **firms**. The study concluded that only in relatively few cases were the costs of accommodating workers with disabilities very high. In many cases, these costs were zero or negligible.

A number of researchers have expressed concern about the validity of the cost data collected given low response rates and inconsistent reporting practices.' Nonetheless, the survey data provide some interesting insights into the costs of accommodation. The tables presented in the report disaggregate the data according to handicapping condition, type of accommodation, occupation, and cost.

The distribution of costs differs by handicapping condition. The most costly accommodations, based on the percentage of costs of \$1,000 or more, were provided wheelchair users and workers who were totally blind. The most costly types of accommodation were the provision of **microfilm** or dictaphones and the removal of barriers. Cross tabulations indicate that employers removed barriers for 56.1 percent of their employees who were wheelchair users and provided dictaphones to 21.2 percent of their employees who were totally blind. The data also indicate that 45.6 percent of wheelchair users were professionals, as were 32.7 percent of all

totally blind employees. By job category, managers, professionals, and technicians received a higher proportion of costly accommodation than other employees.

The Berkeley Planning Associates data suggest that the decisions of employers to invest in accommodations reflect economic considerations. Employers seem to provide more costly accommodations to workers with higher wages and longer job tenure (managers, professionals, and technical employees). Thus, individuals with impairments that are costly to accommodate are more likely to be hired for higher paid jobs (if they are qualified).

This evidence raises the following policy question. Did the 1973 **Rehabilitation** Act affect employer behavior by forcing accommodation or did employers generally accommodate individuals with disabilities who met their needs? Ideally, data are needed to address the prevalence of accommodation prior to the implementation of the ADA.

Summary While the three studies cited above deal with disability in the labor market, none **can** be used to evaluate the ADA. The Berkeley Planning Associates study uses data that are highly suspect and relate to a small sample of employers. The Johnson and Lambrinos study probably overestimates discrimination. The Grossman and **Benham** study is generally outdated but points in the right direction.

V. The Effect of Income Maintenance Programs on Labor Supply among Workers with Severe Disabilities

Other studies conducted in the 1980s investigate the impact of disability payments on labor supply. While the disability focus of these studies is narrower than the ADA, they provide insight into the modelling of labor supply behavior.

Parsons (1980): The first **1980-era** study of the impact of disability insurance on labor -force participation is by Parsons. His primary concern was to explain the decline in labor force participation among prime-age males. He found that increases in DI income accounted for much of the decline.

Parsons uses a sample of 3,219 older **men**⁹ from the National Longitudinal Survey (NLS) to analyze labor force participation in 1969. Wages are based on 1966 measures. Parsons is skeptical of self-reported health measures, and uses mortality to proxy health.” Due to collinearity, wages and DI benefits are not entered in his labor force participation equation separately but are entered as a potential replacement rate. Leonard (1991) notes that since Parson’s findings may simply indicate that low-wage men are more likely to drop out of the labor force.

Because the NLS is a longitudinal survey, Parsons uses observations on actual prior wages. However, prior wages are not necessarily representative of the wages that particular workers could earn after the onset of a disabling condition. In addition, Parsons’ DI benefit

calculations are not based on actual earnings. Moreover, DI benefits are calculated as if **all** individuals could qualify.

Parson's inclusion of mortality as an instrument for health status does not provide sufficient information to distinguish the impact of different disabling conditions on labor force participation. Finally, from the perspective of the evaluating the impact of the ADA, the NLS data for 1969 are too old to be used for current policy analysis as many changes have taken place in the labor force since that time.

Slade (1984): Slade examines- the work incentives of the DI program using a sample of 5,403 men aged 58 to 64 from the 1969 Longitudinal Retirement History Study. The dependent variable indicates whether the individual worked in 1968. Slade includes the ratio of disability benefits (calculated using earnings records) to hourly wages as an independent variable. Wages are imputed to nonworkers, correcting for selectivity bias, using a wage equation which includes a dummy variable for disability. Slade also estimates labor force participation separately for those reporting health limitations and those not reporting limitations. He finds that age does not significantly affect the labor force participation of those with **health** limitations and that higher asset levels are related to lower labor force participation rates.

Slade may underestimate the impact of disability benefits on labor force participation since he imputes DI benefits to individuals who did not report a disability without estimating the likelihood of eligibility. Furthermore, since his sample is limited to workers ready for early retirement, he should have **modelled** the impact of pension benefits more carefully as well. Although Slade runs separate participation equations for individuals with disabilities and those who are not disabled, he only uses a single dummy variable to represent differences in disability status. More generally, any empirical findings based on Slade's study are of limited interest as the data used are over than 20 years old.

Leonard (1979): Leonard finds a strong **labor** supply response to disability **insurance** benefits. He uses a sample of 1,685 men age 45 to 54 from the 1972 Social Security Administration Survey of Health and Work Characteristics merged with Social Security beneficiary records and earnings histories. Leonard's data parallels Parsons' in terms of the age group selected. Leonard estimates the probability of being a disability beneficiary. He uses past earnings from the Social Security earnings records and a set of 27 independent variables for specific health conditions. Imputed DI benefits equal calculated benefits times the probability of being eligible. The probability of eligibility depends on health and background characteristics.

Leonard's 1972 data, however, may not provide applicable **coefficient** estimates for the 1990s. While his study incorporates estimates of the probability of benefit eligibility and uses earnings records to estimate benefits, he **does not** correct his wage equations for selectivity bias.

Haveman and Wolfe (1984): Parsons reports the highest elasticity of DI benefits on labor force participation and **Haveman** and Wolfe report the lowest_ They use a sample of 964 men aged

45 to 62 from the Michigan Panel Study of Income Dynamics (PSID). They construct a variable reflecting the extent of work disability based on self-reported functional limitations. **Haveman** and **Wolfe** estimate equations for labor income and disability transfer income corrected for selectivity bias. Using these predicted values, they estimate a labor force participation equation with work status in 1978 as the dependent variable.

The variables that **Haveman** and **Wolfe** use to represent degree of disability are not significant in their earnings functions. One possible explanation is that the variables representing disability status (in terms of labor market performance) need refinement. Alternatively, disabling conditions may only affect labor force participation and not wages. In their labor force participation equation, **Haveman** and **Wolfe** find a significant negative coefficient for the variable representing percentage disabled.”

The PSID data used by **Haveman** and **Wolfe** are for 1978 and, hence, are relatively recent compared to the some of the other studies surveyed. Nonetheless, these data are 13 years out of date and the coefficients estimated for 1978 may have shifted substantially since that time.

Haveman, Wolfe, and Warlick (1988): **Haveman**, **Wolfe**, and **Warlick** select a sample of 561 men age 62-64 in 1978 using the 1978 Survey of Disabled and Non-Disabled Adults. They estimate transfer and non-transfer income for three possible groupings (working, receiving DI, receiving Social Security early retirement benefits) based on equations corrected for selectivity bias. Four health variables based on a principal components analysis are included.

They use trichotomous conditional **logit** to assess the decision to work, accept DI, or accept early retirement benefits. The results of this model indicate that older workers respond only slightly to changes in transfer and non-transfer income. **The** labor supply response found for this age group is not particularly surprising, however, since most workers tend to retire by age 62. In sum, the age group selected is too restricted to provide baseline information on the labor market prior to the ADA.

Martini (1990): **Martini**’s study investigates the impact of limitations on labor supply and wage determination. He uses data from the 1984 SIPP. He estimates a labor force participation equation, an hours equation, and a wage equation. The wage equation is corrected for selectivity bias. The model is estimated separately for men and women. The labor supply equation is based on samples of over 11,000 men and women. The wage equations are based on samples of over 10,000 men and nearly 9,000 women.

Martini uses two indicators of work disability. One is based on work limitation and the other is based on functional limitation. The wages of male workers with functional limitations are 15.2 percent lower than the wages of men with no limitations. Workers with multiple limitations experience larger wage losses. The wages of workers reporting work limitations are also lower relative to workers with no limitations.

The labor supply equations indicate that the number of reported functional limitations reduces the probability of work. By contrast, self-reported work limitations do not affect labor force participation as much as reported functional limitations. Hours of work are generally lower for those reporting work limitations, however.

Martini's report shows that different indicators of work disability produce different findings. His study should be extended to encompass information on type of condition or impairment which may be as important a determinant of labor force participation as the number of limitations reported.

While Martini estimates pooled equations for all individuals, his work could be extended by running separate wage and labor force participation equations for persons with disabilities and persons without disabilities. If the estimated coefficients for control variables differ between these groups, dummy variables (Martini's method) will not accurately measure controlled differences in wages and labor force activity.

Bound (1989): Bound investigates the labor force participation rates of rejected DI applicants. He finds that rejected applicants are almost as unlikely to be in the labor force as applicants granted assistance. This finding brings into question virtually all the efforts reviewed above (except Martini). In particular, how many of the models confound the impact of disability on work effort with the availability of DI benefits.

Bound uses both the 1972 Survey of Disabled and Non-Disabled Adults and the 1978 Survey of Disability and Work to investigate the work patterns of men age 45 to 64 who were either accepted or rejected under DI. He **selects a** sample of 2,779 persons in 1972 1,272 persons in 1978. He indicates that based on his findings, and on the findings of another researcher (Treitel, 1976), fewer than one-half of all rejected applicants are in the labor force.

Bound suggests that the effect of DI is likely to be lower than otherwise estimated. **The** upshot of Bound's work is that the labor force participation decision of workers with severe disabilities needs to be **modelled** more carefully.

Summary One failing with each of the studies reviewed above is that they do not explicitly model the impact of disability on productivity. In that respect, they also fail to empirically model disabling conditions with sufficient refinement to capture the way in which different disabilities affect productivity on the job and, hence, employment and earnings. Consequently, none of the studies reviewed are comprehensive enough to provide baseline information with which to evaluate changes brought about by the ADA.

VI. Future Needs

The ideal labor market study of persons with disabilities would model labor force participation and wages within the context of the ADA. The data base for such a study would

need to be up-to-date, include key economic and health status variables, and be representative of persons with and without disabling conditions.

Empirical Estimation Two elements are necessary to study the impact of disability on the labor market within the context of the ADA. First, labor force participation and hours worked should be modelled, taking into account supply and demand considerations. Second, wage determination should be modeled and discrimination measured. Labor market outcomes should be differentiated by type of disability and by health status, as particular impairments are likely to affect the supply and demand for labor in different ways. None of the studies reviewed above adequately address the way in which different types of disabling conditions affect labor force participation and earnings.

Variables A study explicitly designed to evaluate the ADA should investigate the impact of physical or mental impairments, corresponding medical conditions, and subsequent work limitations on employment and earnings. The value of DI payments and other income, including Supplementary Security Income payments and payments from employer-sponsored disability plans, also affect labor supply. While income payments have been more carefully modelled, more detailed measures of types of impairment and work limitation are needed.

Several variables have not been included in any of the studies reviewed. No study has investigated how health insurance affects the decision to work. Private health insurance may be difficult for persons with disabilities to obtain on the job (or by any other route) if plans exclude preexisting conditions. For DI recipients, Medicare may be more important than DI itself.

Firm size is another source of wage variation that has not been studied in the context of **disability**. If workers with disabilities are **more** likely to be hired by large firms, the degree of wage discrimination against such workers would be underestimated unless the study controlled for firm size.

Finally, only one study addresses the cost of accommodation. If some employers currently provide low-cost accommodation to qualified workers with disabilities, and other employers make substantial accommodations for employees who **are** valuable to the **firm**, the actual impact of the ADA on the labor force may be less than expected.

Data Limitations The surveys used in all of the studies reviewed above are out-of-date. In recent years, the labor market has shifted strongly away from manufacturing and towards services. The impact of this shift on the demand for employees with disabilities is unclear. Furthermore, technological change may have intervened to improve the productivity of individuals with certain disabling conditions, reducing the costs of accommodation. Information is also needed on shifts in the prevalence of disabling conditions. For instance, while AIDS was not a significant disabling condition in 1978, it is of crucial interest today.

Appendix C
Implications for Employment and Earnings:
Americans with Disabilities Act

I. Introduction

Appendix C addresses some of the labor market implications of the Americans with Disabilities Act (ADA) on the employment and earnings of persons with disabilities as outlined in the text of the report. Economic theory suggests that the ADA will increase the employment opportunities of individuals with disabilities to the extent that discrimination operates in the marketplace. Large employers will be more likely to hire, promote, and retain individuals with disabilities than small employers. The impact of the ADA is likely to differ according to health condition and impairment, as well. While the ADA represents an expansion of civil rights law to individuals with disabilities, it is not the only instrument available to policymakers to encourage greater participation in the labor force. Consequently, other policy instruments should be considered.

II. The Americans with Disabilities Act

Under the ADA, individuals 'with disabilities are persons with physical or mental impairments that substantially limit one or more major life activities. Persons with records of such impairments or persons regarded as having such impairments are included as well. Work disability can be physiological (affecting any number of body systems), mental, or psychological. Individuals who have **successfully** finished drug or alcohol rehabilitation programs are also included.

Under Title I of the ADA, employers **are** forbidden to discriminate against qualified individuals with disabilities in their hiring, advancement, and compensation. Discrimination is also precluded with regard to job application procedures, training, and other conditions of employment. Employers are required to provide reasonable accommodation in the workplace to enable individuals with disabilities to perform the essential functions of jobs for **which they** are qualified. Such accommodation is not intended to create undue financial hardship for the employer.

The ADA implicitly recognizes that unlike race and sex, the definition of disability is multifaceted. Discrimination against persons with disabilities may vary by impairment and functional limitation. The ability of employers to provide jobs and/or redesign jobs whose essential functions can be performed by qualified individuals with disabilities will vary by impairment and functional limitation. Finally, reasonable accommodations for persons with disabilities will also vary according to impairment and functional limitation, as will the costs of these accommodations.

Both the objective facts of work disability and the framework for the implementation of the ADA suggest that its effect will be realized on a case-by-case basis. Furthermore, its impact is likely to vary by type of condition, impairment, and functional limitation. Because it is difficult to frame broad policy outlines for a diverse population, case-by-case implementation is a logical outcome. Yet in this environment, particular decisions of the courts can potentially carry too great or too small a weight in terms of the economic consequences of the Act.

III. Implications of Anti-discrimination Provisions

It is generally believed that persons with disabilities suffer discrimination in the labor market not dissimilar to that faced by minorities and women. In other words, they are less likely to be hired, less likely to be promoted, and more likely to be paid less for similar work.

Evidence suggests that earlier civil rights legislation prohibiting discrimination against minorities and women led to greater employment opportunities and increased wages. In this regard, the ADA should provide the same advantages to persons with disabilities. Nonetheless, reductions in discrimination will be difficult to measure due to differences in the amount of labor supplied by persons with disabilities and due to differences in the productivity of persons with disabilities. If individuals with impairments visually recognizable impairments suffer greater labor market discrimination, greater gains in employment, promotional opportunities, and wages can be expected for these groups.

IV. Implications of Essential Functions Requirements

Under the ADA employers cannot discriminate against qualified persons with disabilities who can meet the requirements for the essential functions of the job. If employers discriminate against persons with disabilities by refusing to hire or promote individuals who cannot meet nonessential job functions, employment opportunities for persons with disabilities ought to be increased.

Economic theory suggests that large employers will be able to structure jobs more narrowly than small employers, enabling qualified persons with disabilities to meet the essential functions of the job. In a simple case, clerks in a large store with many employees are less likely to be called upon to lift heavy store inventory than clerks in a small store with few co-workers. If it produces no undue hardship for large employers to restructure positions so that persons with disabilities can meet essential requirement, employment among persons with disabilities ought to increase in large firms relative to smaller employers.

V. Implications of Reasonable Accommodation

Under the ADA employers must make reasonable accommodation in employing persons with disabilities. Reasonable accommodation may be of two types. First, employers must make existing facilities used by employees readily accessible to and usable by individuals with disabilities. Second, employers must implement job restructuring, through either part-time or modified work schedules or through reassignment to a vacant position. Similarly, employers must accommodate individuals with disabilities through the modification of equipment or devices, through the modification of training materials or examinations, or through the provision of qualified readers or interpreters.

The modification of facilities and the modification of equipment or devices all impose costs on employers similar to **fixed** hiring costs. In the absence of the ADA, employers will make such investments if the long-term returns are greater than the expenditure. Under the ADA, some employers will find such modifications easier to comply with without undue hardship. Again, those employers will tend to be in large **firms**.

The employment of persons with disabilities can take place in two ways. In the first case, persons with disabilities may enter or reenter the labor market or change jobs. Under the ADA employers must hire qualified individuals who meet the essential functions of the job. In addition, employers must accommodate such individuals through the modification of equipment or devices, if such accommodation can be provided without undue hardship.

In the second case, workers may become disabled on the job. This case is likely to be prevalent since data show that the prevalence of work disability increases with age. While the labor supplied by workers whose disabilities are recent may lead them to withdraw from the labor force either temporarily or **permanently**,¹² some employees may wish to continue on the job if reasonable accommodation can be provided.

Employers have three choices when one of their employees becomes disabled on the job. They can retain that employee in the same position, they can transfer the employee to another job, or they can suggest that the employee leave the **firm**. Firms that are self-insured for workers' compensation are obliged to pay benefits directly to entitled workers who do not return to work. Most large **firms** are self insured. In that case, the net wage paid to the worker with a recent **disability** will equal the difference between the worker's gross wage and the workers' compensation benefit that would have to be paid. Consequently, it may be worthwhile for large employers to provide accommodation and retain persons with disabilities, in cases in which it would be too costly for small employers. Consequently, both currently and under the ADA, large employers should be more likely than small **firms** to retain workers with disabilities.

VI. Additional Considerations

Labor supply arguments also suggest that individuals with disabilities may prefer to work for large **firms**. If large employers can accommodate workers with disabilities through job restructuring, those **firms** may provide part-time and flexible job openings that meet the needs of individuals with disabilities who are interested in securing employment.

Similarly, large **firms** may be able to provide health insurance for persons with disabilities more easily than small **firms**. The ADA states that the Act shall not be construed to prohibit or restrict insurers or organizations from sponsoring benefit plans from classifying risks that are inconsistent with state law. Small employers are less likely to have health insurance plans that are self-insured. Plans are now more likely to restrict insurance for preexisting conditions and to place caps on benefits provided. Consequently, individuals with disabilities are more likely to receive meaningful health insurance from large employers who can spread the risk over a larger insurance pool. Thus, individuals with disabilities may **find** employment offers from larger **firms** more attractive than offers from smaller employers.

Aside from the ADA, other public policy alternatives should be considered that would encourage individuals with disabilities to remain in, or reenter, the labor market. Alternative policies could potentially increase labor force participation without distorting economic incentives. For instance, under the ADA, reasonable accommodations **are** more likely to be provided by large employers. If agencies other than employers could be called upon to finance job accommodation, however, small employers might **also** hire persons with disabilities in equal measure. For example, tax incentives granted **firms** of all sizes for expenditures on accommodation would be more likely to produce neutral results with respect to **firm** size.

Greater access to health care for persons with disabilities would also reduce supply-side distortions that discourage individuals from accepting employment in small firms. More effective vocational rehabilitation programs could be instituted to develop a larger pool of qualified workers **with** disabilities. Finally, a restructuring of **the financial** incentives embedded in SSDI and SSI could be contemplated to encourage more individuals to reenter the labor market.

Appendix D
Data Base Requirements
to
Study the Impact of the ADA

I. Introduction

Further empirical research on the employment and earnings of persons with disabilities related to the ADA requires up-to-date information on key aspects of the labor market. Appendix B, in conjunction with findings in the text of this report, suggests that prior studies suffer from a number of weaknesses. Two key problem areas are the timeliness of data and the modelling of disability and impairment.

This Appendix describes the "ideal" data set for future analysis. It then evaluates the two most likely data bases from that perspective -- the 1990 Survey of Income and Program Participation (SIPP) and the 1990 National Health Interview Survey (HIS). We conclude that each has strengths and weaknesses but that, on **the** whole, both are strong candidates for future research efforts.

II. The "Ideal" Data Base

A number of data elements are necessary to study the employment and earnings patterns of persons with disabilities, and potentially, relate changes in those patterns to the ADA. The ideal data base would consist of a household survey containing information on health conditions, impairments, functional limitations, and work disability. In addition, the duration of the disabling condition should be identified to determine the time horizon the individual might have had for training or retraining.

Another key ingredient would be the identification of factors related to employer cost and the willingness of employers to hire persons with disabilities. In that regard, the ideal data set would contain information about **firm** size, since large employers are more able to hire workers with disabilities because of their greater ability to restructure jobs and provide reasonable accommodation without undue hardship. Since, the ADA does not require firms to sponsor insurance plans that are based on risks **that** are inconstant with state law, information on **health** insurance coverage provided to workers is also important. Moreover, the ideal data set would have information on the costs of accommodation and on the type of workers' compensation insurance used.

Of course, this data set would need the usual demographic information about individuals, including age, sex, race, education, marital status, and other demographic data. Information on labor force participation is obviously important. For those in the labor market, information is needed on wages, hours worked, job tenure, occupation, industry, and unionization.

While the ADA does not narrowly focus on persons with severe disabilities who may be eligible for transfer payments, information on DI and SSI payments is necessary. A data base linked to Social Security records would be most useful since hypothetical DI payments could then be calculated for every individual, and probabilities could be assigned to DI eligibility using information on health condition and impairment.

Information on other family income is needed, including investment income and spousal earnings. Furthermore, since health insurance represents an important in-kind benefit that may materially affect labor supply, sources of insurance that are not job-related should be included as well. A variety of other variables, including region, would flesh out the analysis.

The ideal data set would need to contain a large enough sample of individuals with disabilities to produce statistically significant results. And, it would have to be large enough to disaggregate the population with disabilities by type of health condition, impairment, or functional limitation. The data set would also have to be up-to-date. Finally, a longitudinal survey or a series of regularly conducted cross-section surveys would permit continuing evaluation of the ADA.

III. The 1990 Survey of Income and Program Participation

SIPP is an ongoing survey of the noninstitutional population conducted by the Census Bureau designed to measure household income and participation in private and public insurance and welfare programs. It contains a sample of approximately 12,000 **households**.¹³ The same panel of households- is interviewed for a period of two and one-half years. Every four months, data are collected from one of four nationally representative "**rotation**" groups. A complete set of interviews for all four groups is called a wave. Certain questions are asked in each interview., These are called "core" questions. Some questions are not asked in each interview but only during certain waves. This group of questions is called a topical module.

The **core** questions in SIPP contain demographic information, information on income, labor force participation, and health insurance. In addition, information is available on wages, hours worked, occupation, industry, unionization. Wave 2 of the 1990 SIPP contains topical modules on employment history and work disability history. The employment history module has information on **firm** size. The work disability module has information on the health condition that is responsible for the respondent's work limitation and on the date of onset of that limitation. Wave 3 of the 1990 SIPP contains topical modules on work schedules and on functional limitations and disability. The work schedule module contains information on days and times of work. The functional limitations module contains detailed information on physical and mental functional limitations. In addition, DI application and reciprocity histories are recorded. Furthermore, these data provide information on the utilization of health care services.

The combination of information in these two SIPP Waves for 1990 make this data set extremely promising for future research on the employment and earnings of persons with **disabilities. These data are scheduled to become available in 1992.**

IV. The 1990 National Health Interview Survey (HIS)

The HIS provides current estimates of health and disability status, health-related behaviors and health care utilization. General demographic information is contained within the data base, as is information on labor force participation, occupation and industry. Information about the onset of work disability is also available. The sample for the 1990 HIS includes 116,000 persons.

Until recently, the survey only collected family income data grouped into broad **dollar**-value categories. In 1990 a special supplement on income and program participation was fielded, providing information on earnings and other sources of income. Full-time and part-time status is identified, as well. The number of months respondents worked over the past year is also indicated. Information on **firm** size is not available.

The 1990 HIS contains a supplement on the use of devices by persons with physical disabilities or impairments. The type of device is identified as well as the source of payment of the device. Source of payment includes government sources, rehabilitation programs, and employers. While **this** information does not necessarily cover all accommodations provided by employers (for instance, structural changes would not be included), it provides an initial opportunity to evaluate the costs of accommodation. While dollar values are not provided, average costs for particular devices, obtained from businesses or other organizations serving persons with disabilities, could be linked to the HIS.

The combination of information in these two 1990 HIS supplements make this second data set extremely promising for future research. Like the **SIPP**, these data are also scheduled to become available in early 1992.

V. Evaluation and Conclusions

Two 1990 data bases that will soon become available represent the best opportunity to conduct research on the employment and earnings of persons with disabilities since the 1978 Survey of Disabled and Non-Disabled Adults. Each data set has different strengths and weaknesses. The **SIPP** provides better information on employment and earnings and contains data on firm size. Firm size is an important theoretical determinant of the demand for labor among persons with disabilities, particularly since the passage of the ADA.

The HIS provides more detailed data on health condition, impairment, and functional limitation than the **SIPP**. The HIS is probably easier to use than the SIPP because of the latter's complicated longitudinal design. HIS labor force data are less detailed than the **SIPP**, however. Detailed information on hours of work and information on **firm** size are not available. Theory suggests that individuals with disabilities restrict their labor supply relative to the able-bodied. Consequently, **more** detailed information on hours of work may be empirically important. The'

HIS supplement on assistive devices is unique and may provide further insights into the costs of accommodation faced by employers.

Ideally, future studies should utilize each of these data sources. The strengths of each data set should also be exploited to determine how more detailed information on particular aspects of the labor market affects findings on patterns of employment and earnings among persons with disabilities.

End Notes

1. The pertinent time endowment is the difference between a calendar time endowment T^* and the time needed to maintain the human agent T_m ; $T = (T^* - T_m)$. A healthier person has a larger stock of health capital and needs less maintenance time, $(dT_m/dA) < 0$. James Lambrinos (1978) makes a similar point when he argues that a disabled person experiences more “down time”.
2. The working age adult population is ordinarily defined to include persons 18 to 64 years of age. LaPlante chose to extend the interval to 69 years of age. Data from three health Interview Surveys were combined to obtain a larger sample. LaPlante placed the impairments and chronic conditions into six groups. I took the liberty of combining them into ten groups as follows: (1) Musculoskeletal: arthritis, bursitis, psoriasis & dermatitis, (2) Orthopedic Impairments: absence of limbs, paralysis of extremities, cerebral palsy, **spina bifida**, back and other orthopedic impairments, stroke & multiple sclerosis. (2b) Blind: blind in both eyes, cataracts, glaucoma. (2d) Deaf: Speech impairment, deaf in both ears, other hearing impairments. (3) Digestive: ulcers, hernia, enteritis & colitis. (4) Circulatory: heart diseases, hypertension, arteriosclerosis. (5) Respiratory: asthma, bronchitis, sinusitis, emphysema. (6) Miscellaneous: diabetes, anemia, kidney, genital, epilepsy, senility, other injuries. (C) Cancers: skin cancer, bone, digestive, lung, leukemia, breast. (M) Mental: schizophrenia, neuroses, alcohol & drug, mental retardation.
3. If $V_1 < W$, then $(W\tau+c) < WT$. Recall that $(T-\tau) = J$, the time needed for the journey to work. The inequality is thus met if $(c/W) < (J/T)$ meaning that the relative money cost of the work-trip is less than the relative time cost.
4. Recall that $F = VTN+Y$, and a fall in T reduces both V and T . The supply of workdays depends on the ratio of L_1 to T ; $K = N - (L_1/T)$. A 1 per cent decrease in T must lead to more than a 1 per cent decline in non-workday leisure to result in a decrease in K .
5. The Michigan Panel Survey of Income Dynamics, **PSID**, was screened to obtain a sample of married male household heads reporting for five successive years, 1968-72. Records for 1,760 whites and 771 non-whites revealed that 13.1 per cent of the whites and 18.3 per cent of the non-whites were disabled in 1972. However, the percentages who were disabled in each of the five years were 4.9 and 5.8 per cent.
6. See the models of Gary S. Becker (1964), Yoram Ben-Porath (1967), and Walter Oz (1962).
7. All of these persons were judged under the SSA disability determination process to be so severely disabled that they were unable to work. The SSDI program imposes a two year waiting period before a beneficiary is entitled to **medicare** benefits. The objective of the Bye-Riley study was to evaluate the merits of eliminating this waiting period.
8. The death rate was 6.7 per cent for those under 40 years of age but jumps to 13.4 per cent for the 40-49 age group. It continues to climb, but the increment to the oldest age group is only 1.4 percentage points.

9. This can be modeled by introducing the health capital of the male household head, $A = A_m$ into the family utility function; $U = U(X, L_m, L_f, A)$ where $dU/dA = U_A > 0$. A decrease in A directly reduces the family utility, but it will also affect the marginal rates of substitution of the other three arguments.

10. The labor force participation rate of older women did not exhibit the same secular decline which may be due to the fact that fewer older women had accumulated sufficient quarters of covered employment to qualify for benefits. Haveman, DeJong, and Wolf (1991) question the accuracy of the estimates by Parsons and by Leonard.

11. We reproduce the language from the EEOC Regulations for title 1 of the Act.

- (1) In general, the term *essential functions* means the fundamental job duties of the employment position, the individual with a disability holds or desires. The term **essential functions** does not include the *marginal functions* of the position.
- (2) A job function may be considered **essential** for any of several reasons including but not limited to the following: (i) the function may be essential because the reason the position exists is to perform that function, (ii) the function may be essential because of the limited number of employees available among whom the performance of that job function can be distributed, and/or (iii) the function may be highly specialized so that the incumbent in the position is hired for his or her expertise or ability to perform the particular function.
- (3) Evidence of whether a particular function is *essential* includes but is not limited to (i) the employer's judgement as to which functions are **essential**, (ii) written job descriptions prepared before advertising or interviewing applicants for the job, (iii) the amount of time spent on the job performing the function, (iv) the consequences of not requiring the incumbent to perform the function, (v) the terms of a collective bargaining agreement, (vi) the work experience of past incumbents in the job, and/or (vii) the current work experience of incumbents in similar jobs.

12. In the EEOC regulations,

- (1) "The term **reasonable accommodation** means (i) modifications to a job application process that enable a qualified applicant with a disability to be considered for the position such qualified applicant desires or (ii) modifications or adjustments to the work environment or to the manner or circumstances under which the position held or desired is customarily performed that enable a qualified individual with a disability to perform the **essential functions** of that position or (iii) **modifications** or adjustments that enable a covered entity's employee with a disability to enjoy equal benefits or privileges of employment as are enjoyed by its other similarly situated employees without disabilities.

- (2) Reasonable accommodations may include but is not limited to (i) making existing facilities used by employees readily accessible to and useable by individuals with disabilities and (ii) job restructuring, part time or modified work schedules, reassignment to a vacant position, acquisition or modification of equipment or devices, appropriate adjustment or modification of examinations, training materials, or policies, the provision of qualified readers or interpreters, and other similar accommodations for individuals with disabilities.
- (3) To determine the appropriate **reasonable accommodation**, it may be necessary for the covered entity to initiate an informal, interactive process with the qualified individual with a disability in need of the accommodation. This process should identify the precise limitations resulting from the disability and the potential reasonable accommodations that overcome those limitations.

13. Chirikos (1991) reviewed the studies that revealed modest accommodation costs for the comparatively small number of disabled persons who were gainfully employed. He argued that if the Act is successful in expanding employment, workplace accommodation costs could sharply rise as employers hire individuals with more functional limitations and impairments. The efficiency of placing the cost burden entirely upon employers is questioned by S. Rosen (1991). If **the** accommodation is **reasonable** and specific to the particular worker-firm attachment, a strong case can be made to share the costs.

14. The eight variables were (1) health, (2) missed experience equals the number of quarters that the individual did not work, (3) general experience, (4) specific experience **with** the current. or last employer, and its square, (5) education, (6) capital intensity equals a dummy variable for the goods producing industries plus transportation, communications, and utilities, (7) public sector equals one if working in this sector, and (8) race. The **first** five variables are proxies for the individual's stocks of health and human capital. Following Richard Butler (1983), the authors included three "demand side" variables.

15. Johnson and Lambrinos embraced a narrow **definition** wherein handicapped workers were limited to those whose impairments affected communications, visibly altered bodily movements, or are in some way deforming. These included total deafness, inability to read ordinary print with glasses, blindness, partial or complete paralysis, convulsive disorders, distortions of limbs or spine, and mental illness. Persons with arthritis, heart conditions, digestive disorders, or neoplasms which were not severely disabling were placed into the non-handicapped group.

16. The methodology was borrowed from Cordelia Reimers (1983) who proposed using weighted averages for the endowments X and the parameters B.

$$X^* = (1-k)X_1 + kX_2.$$

$$B^* = kB_1 + (1-k)B_2.$$

Johnson and Lambrinos set $k = 0.5$.

17. The coefficients for the public sector dummy variable were .071 for non-handicapped men and .182 for handicapped men; i.e. hourly wages were 7.1 and 18.2 per cent higher if the individual is employed in the public sector. The coefficients were .161 and .162 for the non-handicapped and handicapped women. See Johnson and Lambrinos, Table 1, p. 271.

18. The incidence of disability is related to sex, race, age, and education. The empirical patterns reported here are observed even when these personal characteristics are held constant.

Endnotes for Appendices

1. Data from the Retirement History Survey reveal that this assumption is often violated. People do re-enter the labor force after often lengthy periods of non-participation. This problem of determining when an individual truly retires is examined by Marjorie Hoenig and Cordelia Reimers (1990).

2. If he is already retired and remains retired, the budget constraint, (A.1) is replaced by,
$$\Sigma B_j X_j = Y_0$$

3. This study builds on that of **Haveman** and Wolfe (1990).

4. Not every year is selected, however.

5. These percentages are based on survey definitions and are consequently not related to the actual degree of functional impairment involved.

6. Even using DI recipients as a proxy for the severely disabled may be inaccurate. For instance, work by **Nagi** (1969) strongly implies that the DI determination decision errs on both sides. In other words, some disabled workers who should receive benefits are denied and some who receive benefits ought to have been denied. While the percentages on each type of case are unknown, the subject remains politically sensitive.

7. For a more technical explanation see Appendix A.

8. For instance see **Oz** (1991).

9. These men were age 45-59 in 1966.

10. Other studies suggest that self-reported health conditions represent actual health status rather well. For instance see Maddox and Douglas (1983). Similarly studies have found that the correlation between trends in health status and mortality is weak. For instance, see Verbrugge (1984).

11. A British study similar to **Haveman** and Wolfe presents projected labor force participation rates for men who have suffered significant illness or injury (**Fenn** and Vlachonikolis, 1986). They indicate that labor force participation varies **strongly** for men in all age groups depending upon the persistence of residual **health problems stemming from the illness or injury**.

12. This situation is discussed extensively in the text of our report.

13. The SIPP started out with a sample of 20,000 households for the 1984 panel. Panel size was reduced to 12,000 households in 1985. An over-sample of 20,000 households has been proposed for 1995 and later.

Endnotes-

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